EVERYMAN'S SCIENCE

Vol. XLII No. 2 (June '07 – July '07)

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Printed and published by Prof. S. P. Mukherjee on behalf of Indian Science Congress Association and printed at Seva Mudran, 43, Kailash Bose Street, Kolkata-700 006 and published at Indian Science Congress Association, 14, Dr. Biresh Guha Street, Kolkata-700 017, with Prof. S. P. Mukherjee as Editor.

Annual Subscription : **(6 issues)**
Institutional Rs. 200/- ; Individual Rs. 50/-
Price : Rs. 10/- per issue

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EDITORIAL

SKILL is a commonplace and yet a mind engaging term. Normally we claim to understand it, and yet it is an undeniable fact that we need to gain good deal of scientific insight into the dimensions of the events that justify use of the term SKILL.

Some tribals in India are known to have possessed amazing skill. We have heard about certain tribal people catching birds throwing sticky pieces of sticks towards them, prepared crudely from parts of tree branches. Certain tribal groups of Orissa and Hill Kherias of Jharkhand have been using such tree branches as digging/hunting sticks since ancient times. Such expert skills are not unknown but have hardly been taken note of in serious scientific research in our country.

Economists have long recognized that the advance of human know-how or skill is the central driving force behind the remarkable increase in living standards. M. Polanyi attempted a serious study on this topic. His 1958 publication (Personal Knowledge : Towards a Post-Critical Philosophy. Routledge & Kagan Paul, London) bears testimony to this fact. We have now been given to understand that some of human skill is 'articulated' in the sense that it can be described and communicated in 'some form of language' or other symbolic system, while other aspects are 'tacit'.

We have so long dealt on a few instances of human skill. But, skill is not an exclusive trait of *Homo sapiens*. Skill for food gathering/hunting, for fighting and for developing certain forms for social togetherness or compartmentalization/ segregation has also been evinced among other primates, animals and even birds. We often admire certain commonalities among diverse biological organisms, for example, singing skill of certain birds like those found in human individuals. Manifestations of skill are found in several forms of biological activities, all of which strongly suggest that the key lies in understanding behavioural adaptability. Once this is realized, it will not be difficult to strike some common note among humans, animals, birds and even plants.

A very thought provoking issue has been raised by Darlington Jr. in his 1975 article in the Proceedings of National Academy of Science, U.S.A. (Vol. 72, No. 9 pp3748-752) He has called upon ecologists to find the answer to questions like : why does an animal/plant stay in the environment it is adapted to despite the overwhelming impression that the plant or animal in question does not calculate the advantages. The answer probably is that the plant/animal finds its environment satisfying or pleasant and hence it must have evolved obvious structural and behavioural characteristics that determine fitness.

Modern evolutionary biologists tend to give top priority to measurable parameters. Defining and working on such parameters are definitely welcome. But, we have to probe even beyond. We may consider, for example, the case of throwing. Van Lawick-Goodall recorded throwing skill of wild chimpanzees and found them ineffective in achieving target-oriented results (cf. H. Petroski, 1992 : The evolution of useful things. Alfred Knopf, New York). In comparison, a skilful tribal from the Chotanagpur region of Eastern India has a good chance to break a wooden stick located 30 metres away with one stone. Such skilful throwing or stoning is known to have prevailed among Australian aborigines and also among a considerable number of tribals in India which proved to be main means of their subsistence and adaptation. Throwing thus helped not only in food procurement and fighting but also in brain evolution and in advancing social effects. Therefore, when we talk about preserving the tribal areas with reference to their food habits, hunting and more pointedly agrarian

techniques, we effectively aim at preserving human skill diversity. What we thus need is translating our aesthetic appreciation into deeper scientific understanding of these skills.

Some attempts have been made in this direction. Nottebohm and his Rockefeller group (cf Proc. Natl. Acad. Sci., U.S.A., 1984, Vol. 81, pp 6232-234) studied the singing skill of Oscine Songbirds and found that they learn their song by modifying their vocal output until it matches an auditory model. Concluding from their electrophysiological studies, they have established that song is a motor skill usually modified to a great extent by learning. The models learned are passed on from one generation to the next. This is in a way similar to the fishing skill of our fisherman or a folk dance form of a particular group of people. There is another interesting instance of brain process promoting acquisition of adaptive cultural traits. During his recent tour of Jaldapara Rhino Reserve, one of my close associates, Dr. Arunava Goswami, who is also the co-architect of this editorial piece, found that each year grasslands for Rhinos are produced by burning the old grasslands. One has to agree with Dr. Goswami's conclusion that this skill in the matter of designing ecological niche for Rhinos is the result of years of brain evolution. These and other instances of brain processes promoting acquisition of adaptive cultural traits definitely indicate the positive role played by natural selection, leading to a coevolution of culture and brain. Unfortunately, however, this so very important and vital area of evolutionary study has been paid much less attention whether in neurobiology or in behavioural ecology. Once this is relaized, it will not be difficult for us to comprehend that growing seeds of an exotic crop, finding medicinal value of a weed, or, developing a paricular food habit and lifestyle are all indicative of human skill development. Even insects too have shown remarkable skills. An article published in Nature in 2005 (D. L. Hu and J. W. Bush : Meniscus climbing insects ; Vol. 437 pp 733-736) explains lucidly the wonderful skill of water-walking insects in passing from water surface to land negotiating easily the menisci in between. Thus, when we think of preserving these insects, we are, in reality, contemplating preserving these skills.

Even though we have observed, studied and noted remarkable advances in skill that all living forms have achieved, we are still far from comprehending them at the mechanistic and applied levels. These and many other issues like extremely uneven advances of effective human skills across different economic sectors and classes of human needs, nature of other skills found in plants, (structural and behavioural characteristics determining evolutionary or adaptive fitness), insects and animals, how they are organized, where they are located and how they are applied call for serious study across the length and breadth of our country through establishment of a few basic research institutes engaging in behavioural ecology, biodiversity and conservation management. A positive step in this direction will be a great contribution in preserving biodiversity derived skills, which advance evolution.

S. P. Banerjee

"No one gossips about other peoples' secret virtue.

— Bertrand Russell

PRESIDENTIAL ADDRESS

MINERALS' SHARE IN THE WAR

DR. D. N. WADIA*, M.A., B.SC., F.G.S., F.R.G.S., F.R.A.S.B., F.N.I.

The Indian Science Congress meets today for the fourth time since the beginning of the war. This meeting, only a few hundred miles remote from one potentially active war theatre, is an event which bears significant testimony to the place Science has won in India. The attendance of so many members, drawn from many fields of scientific activites and Government Institutions from almost all parts of the country, provides gratifying proof of their devotion to the cause of Science and of their subscribing to its exacting ideals. Calcutta has once again made its contribution to the spread of Science in India by inviting the Congress for the sixth time. We keenly appreciate the warm hospitality it has accorded us under conditions of difficulty we all realize and it is no mere formal expression of thanks that, in your name and on your behalf, I tender to the organizers of this session. A distinguished citizen of India was to have presided at this meeting and no one here shares, more keenly than I, in the disappointment at his absence today. I seek your forbearance at my having to address you because of an existing rule which requires your President of the foregoing year to continue in office until its assumption by his successor. Pandit Jawaharlal Nehru's contributions to Science in India have not been in the limelight, but they have been a leavening influence in the organization and working of the National Planning Committee which, since 1939, is engaged in the great task of co-ordinating Applied Science with productive industry in every field—industrial, educational, cultural and organizational. Ladies and Gentlemen, please believe me, I sympathize with you for having missed his rousing address.

Death has removed from our midst during the year several distinguished workers in different fields of Science. The Indian Science Congress mourns the deaths of : Rai Bahadur Ramaprasad Chanda, anthropologist, archaeologist and student of Indian art; Rai Bahadur Sarat Chandra Roy, Tibetan scholar, archaeologist and founder-editor of *Man in India*; Mr. Gauripati Chatterjee, meteorologist, distinguished for aerological researches in upper air; Dr. G. de P. Cotter, late of the Geological Survey of India and a past President of the Section of Geology; Colonel Sir Francis Younghusband, reputed soldier, Central Asian explorer, geographer and a close student of Indian Philosophy.

Reviewing the events of the year that has passed, the most outstanding and dominating event was the approach of the war to the doors of India. For the first time in the 4 millenniums of recorded Indian History, the enemy has assaulted the eastern boundary of the country. Our sea and our long eastern walls have been approached and threatened by the invading enemy. But equally significant in the annals of 1942 was India's answer to the invaders, the answer conveyed through its munitions factories, electric, chemical and the host of technical

* General President, Thirtieth Indian Science Congress held during 31st January to 5th February, 1943 at Calcutta.

plants, industrial research laboratories and the hundreds of young University-trained men manning engineering, medical, naval and air corps during the year. This may truly be regarded as the greatest event of the last few years in the cultural life of the country—for the first time after her age-long belief in the force of philosophic and spiritual striving as the goal of life, India has taken up the challenge of Science and the machine and is adjusting itself intelligently and conscientiously and with surprising quickness, to compose a society in which strivings for both material and spiritual well-being are equally regarded as ruling factors in a perfect life. That indeed is an ideal difficult to achieve for any people, but in present-day India the changeover is taking place at a remarkably accelerating pace. Indian scientists by their last 30 years' work in different branches of Science have made a notable contribution towards fostering the new mental attitude which has brought about this difficult welding. H. E. Lord Linlithgow happily expressed the need of such welding for the people both of the East as well as the West in his opening address before the Jubilee Session of the Indian Science Congress held in Calcutta in 1938. "Even the most enthusiastic believer in Western civilization must feel today a certain despondency at the present failure of the West to dominate its scientific discoveries and to evolve a form of society in which the material progress and spiritual freedom march comfortably together. Perhaps the West will find in India's more general emphasis on simplicity and the ultimate spirituality of things, a more positive example of the truths which the most advanced thinkers of the world are now discovering." To this consummation Philosophy and Science must aim if the one is not to end in ultimate futility after ages of persistent effort and the other not to achieve, as a reward of its magnificent discoveries and inventions and its conquests over Nature, a barren desert of frustration through a succession of world wars.

MINERALS' SHARE IN WAR

A geologist's work during wartime is largely mobilizing all mineral resources in his own limited sphere for munitions purposes. Free international movement of minerals having ceased, every country has to produce the full quota from its domestic mineral resources. Far-reaching questions will arise in the near future, if indeed some have not already arisen, as to how long minerals from accessible depths of the earth will be able to sustain man's wars.

Man's advancement to civilization from the hunter and peasant stage is due to his mastery over metals and minerals, but this advance has caused most serious inroads on the world's stock of minerals and especially of metals. During the century and quarter between the Napoleonic wars and the Hitlerian war, the consumption of minerals has been over a hundred-fold of that consumed during the entire history of man on earth and so far as metals are concerned, man has used up between 1914 and today, between the two German wars, more metals than during any previous period of history. Metals such as tin have almost reached depletion stage, silver is being made to stand substitute for tin, while the extractable stock of platinum, silver and gold left for future needs of the world within manageable depth will be very meagre. The consumption of fossil fuels, coal and petroleum has been at a far more serious rate, so serious that the world's known reserves of mineral oil at the present rate of production will be exhausted in a few decades. The total world coal reserves are larger, but they will last only a few decades longer, if the present acceleration of production and consumption of coal and its use for the ever-lengthening catalogue of by-products continues in the future at the same rate. So far no checks have been devised for this alarming depletion of the world's underground wealth—this robbing of the earth by the living generation at the expense of future generations. Metals and minerals are a

rapidly wasting asset of a country for which there is no renewal or replacement. Agricultural and forest resources of a land can be rejuvenated by suitable measures and manures, but no fertilizer can revive one exhausted mine, for geological processes are exceedingly slow requiring hundreds of thousands of years to form a vein of metallic ore or a bed of coal.

There are some 1,500 distinct species of minerals known; of these about 200 find application in commerce and industry and are considered economic minerals. Among these again there is a rapidly mounting list of metals and minerals which are of vital use in the manufacture of munitions of war and of highly specialized commodities of strategic use. In the defence programme of a nation under the present-day conditions of totalitarian warfare, the metallurgical industry and its ancillary mining of minerals yielding the ferrous and alloy metals, fluxes, refractories and accessory minerals are of essential importance. A significant feature of the distribution of these minerals is the concentration of their production and manufacture in a comparatively few countries in the world, happily nearly three-fourths of these being centred in, or controlled by, the United Nations as against the Axis group. Of the total annual mineral production of the world in pre-war years, as much as 85% came from North America and Western Europe, of these U.S.A., England and Germany and latterly Russia contributing over 75%. This, however, does not mean that Nature has endowed these countries to this unequal extent with valuable minerals, it rather is an index of the country's industrial and technical development and the energy of the people. Russia's three successive five-year plans are an example of this. Industrial progress of other parts of the world may materially change this condition. For instance, China's vast reserves of coal, hitherto untapped for lack of economic employment may, in the not distant future, be put to use in metallurgy, or in the production of heat energy or other profitable channels. India's resources in iron ore are of a magnitude quite out of proportion to the bare couple of million tons of pig iron per year it has only recently begun to produce. Only in a few districts of Bihar and Eastern States Agency, the high-grade iron ore reserves are calculated to be of the order of 4,000 million tons. Large reserves of aluminium ore are still only potential assets. The minerals of South America and Africa are yet in an early stage of development, while Australia's store of mineral wealth is yet unknown over wide tracts of that region. When these untouched reserves enter production stage, the apparent inequalities will diminish and the countries bordering the North Atlantic basin will not occupy the dominating position in strategic minerals they do at present.

But even so, when the whole world's mineral resources are fully known and mobilized, the stock will not last many generations, if it is made to feed the waste of recurring wars on the scale of magnitude and frequency of the last two world wars. If the supply and free movement of a few ferro-alloys and a few strategic key minerals for non-industrial uses is controlled by some central world organization, the demon of totalitarian war can be banished and the remaining wars shorn off their insane waste involved in military as well as non-military devastations. Then the wreckage of tanks and armour-plates can be beaten back into ploughshares and its superior steel released for beneficent uses in peace.

It is no exaggeration to say that half of the later wars of history have been directly or indirectly motivated through the desire of gaining access to stores of strategic mineral products, ores, fuels, salts, alloy metals and essential industrial minerals.

The international mineral situation during pre-war years was in a chaotic state. While the United Nations were in a state of "vacuous unwareness" about it, the Axis powers grabbed as much of the indispensable munitions minerals as they wanted

and the war has been waged by them on the stores of hoarded minerals and metals.

Only the adoption of a wise and justly planned international mineral policy framed by an International Directorate can preserve peace and good-will amongst countries unequally endowed by Nature with mineral wealth. No country in the world, however well-supplied it be, is self-sufficient in mineral requirements, nor is any so situated that it can regard its mineral resources as purely domestic or national. Embargoes, tariffs, patent rights and transport controls imposed for political reasons do not offer a solution, but by hindering free movement of minerals they become powerful contributive factors in precipitating world wars. Unequal geographical distribution of minerals being an unalterable fact, planned international economy should devise means not only to eliminate this cause of inter-country friction but to increase the interdependence of nations on each other for their vital trades and industrial needs and so make minerals a rallying point for international cooperation and good-will. The preliminary recommendations of the Conference on "Mineral Resources and the Atlantic Charter", convened by the *British Association's* Committee on Social and International Relations of Science last July, appear to be on the right lines, but they will not go far enough if their implications are meant to safeguard the interests of the British Empire only, or even of the whole United Nations' group. These should embrace all the free countries and should call for sacrifice from all participating nations of part of their national and natural advantages for the ultimate benefit of all and the future security of the peoples of the world. The main resolution of this Conference. reads as follows :

"This Conference, having specifically dealt with mineral resources, submits that, as a first step, the Council should initiate forthwith consultations with appropriate scientific and technical organizations, to secure an understanding on the principles involved. The Conference would further urge that a scientific review of mineral resources, using and supplementing all existing data, should be among the first tasks of any international organization for the social applications of Sciences, such as was envisaged at the recent Conference on Science and World Order. To this end, the Conference recommends that the Council should consider how it might help to promote the establishment of an International Resources Organization, as a fact-finding and advisory body for Governments, as a contribution to world stability, and in the spirit of the Atlantic Charter."

The fourth article of the Atlantic Charter postulates access for all States on equal terms to the raw materials of the world. But if the Atlantic Charter does not unreservedly provide for all peace-loving nations of the earth, whatever oceans bound them, its fulfilment in a partial degree will not achieve the goal of post-war mineral allocation, nor succeed in removing a focal infection point in the body politic of the world.

The position of mineral affairs today being what it is, it behoves us as non-Utopian Science workers to ask—What is India's place in the world's mineral map? The mineral outlook of the Indian region is on the whole satisfactory both for war and peace-time requirements. India's resources in minerals of strategic importance, minerals for munitions and defence armaments, base metals, alloys, fluxes, refractories and accessory minerals can be regarded as adequate, in several but not all of them. India is deficient in tin, tungsten, lead, zinc, nickel, graphite and liquid fuels. But in the basic metals, iron, manganese, aluminium and chromium, the country is well-supplied, in the case of the former three, in large excess. Our neighbour. Burma, has abundant stocks of the munition metals of which India is in defect, while her oil resources must yet be regarded as considerable. Ceylon has reserves of the world's finest graphite, a mineral indispensable in metallurgy and of a magnitude

sufficient to last a long period. Ancillary minerals such as asbestos, cement, fertilizers, clays, mica, sulphur, various salts, ores and other minerals of industrial utility are available in quantities sufficient for the country's needs, while some are in exportable surpluses.

The experience of the last three years' war effort in the production in India of a wide range of munitions, without any previous apprenticeship, is satisfactory proof of the country's adequacy in some respects, though still unequipped in a number of essentials, viz. specialized steels, machine tools, manufacture of aircraft, high explosives, automobile engines, big ship construction, etc. on a scale commensurate with her internal requirements.

THE SOCIAL OBLIGATIONS AND RELATIONS OF SCIENCE IN INDIA

Last year, while addressing you on the progress of the exact Sciences in India during the last 30 years, I stated that the retrospect was satisfying and held out promise of further developments. The time, however, has come, and the events of the last few years forcibly remind us of the fact that Science, as pursued in the laboratory and the field, is becoming more and more a specialist's job and is becoming divorced from the life of the people. Science, as applied to the problem of daily living and the social needs of the common man, is the great necessity of the day. The advent of the motor bus, the radio and the railway engine in the villages of India is not same thing as bringing Science to the homes of our villagers. The impact of Science on the Indian masses has come in the form of a rather rude intrusion of machines and mechanics into the essentially simple rural economy of the country and it is not surprising that this meeting has not been a particularly happy one. It has disturbed the economic structure and created, if not some aversion, an indifference to the cult of Science in the popular mind. But we all know that Science is not all mechanics nor are its practical uses to man the greatest thing about Science. The greatest thing about Science is the scientific method—the most effective thing man has for discovering truth and the ways of Nature. It can bring solid benefits by releasing life from stagnation and the bonds of ignorance wherever these prevail, whether in cities or in the countryside, among the labouring masses or among the governing class. The awakening to the social obligations of Science is of recent date and even in Europe and America this aspect of the cultivation of Science was for long not realized and left to sporadic individual efforts. With this awakening, a two-fold problem faces Science all over the world today—to press the newest discoveries and inventions of applied Science into the service of agriculture, manufactories, hospitals, homes and schools, and alongside with it to so control the impact of these on his private life that his mechanized work-a-day life may not be totally divested of all higher spiritual values. Our future national life and its material well-being largely depend on a wholesome balance being maintained between these two—the impulse to harness Science to increase physical comforts of life and a restraining desire to preserve the old-world spiritual calm and simplicity of living. Happily for India, this balancing is somewhat of a natural hereditary trait and does not need much emphasis. While in the European countries the evolving of a true synthesis, a *via media*, demands much searching and learned arguing, our age-old traditions have made this work easier. India's late start in the application of Science to industry also gives it an opportunity of planning along right lines. The significance of this problem has been realized by both our political leaders as well as scientists, and some progress is made in this direction. I refer to the inauguration in 1939 of the National Planning Committee under the chairmanship of Pandit Jawaharlal Nehru, with the specific object of coordinating science with industry in all its phases, and to the establishment by the Indian Science Congress at its Lahore session in

January, 1939 of a sub-committee on Science and Social Relations, mainly with the object of studying the influence of Science on India and collecting data relating to the effects of Science on society in India.

The National Planning Committee, through its 29 sub-committees, has set out on formulating a programme covering many phases of the country's future life and activities, material, productive, educational, artistic. Their work unfortunately is in a great measure suspended today, though some of the 29 sub-committees have furnished more or less complete, well-documented reports, while others have submitted interim fact-finding reports. Their conclusions, doubtless, will be subjected to thorough revision and deliberation by the main body which comprises 200 of the leading industrialists, publicists and scientists of the country, before they are offered to the public, but a great deal of spade work is accomplised, a valuable mass of ascertained classified details collected and many blue prints prepared. A planned reconstruction in a greater or less measure of India's commerce, industry, finance, land, labour, mining, transport, power-generation, technology alongside educational, cultural and social re-organization is expected to emerge from the labours of this body.

PROPOSED ACADEMY OF SOCIAL SCIENCE FOR INDIA

The Executive Committee of the Indian Science Congress has before it a proposal for the institution of a National Academy of Social Sciences drawn up by the sub-committee on Science and Social Relations. It is interesting to trace the origin of this sub-committee which goes back to the Blackpool meeting of the British Association for the Advancement of Science in 1936, which meeting was devoted to the discussion of the Social Relations of Science. In the following year, a few leading Science Associations took cognizance of this subject. The International Council of scientific Unions with its headquarters at Delft, Holland, at its meeting held in April, 1937, in London, established a Committee on Science and Social Relations with Professor F.G.M.Stratton, of Cambridge University, as President. This action of European scientists was followed by a resolution passed by the American Assocation for the Advancement of Science at its meeting in 1937 urging the various scientific organizations of the world to re-undertake examination of the profound changes brought about by Science in human society and thus to be in a position to promote "peace among nations and intellectual freedom in order that Science may continue to advance and spread more abundantly its benefits to all mankind". In 1938 the British Association at its meeting held at Cambridge brought into being a special Division for Social and International Relations of Science with Sir Richard Gregory as its Chairman. This division organized a Conference on "Science and the New World Order" in London during September, 1941. In conjunction with these sister organizations of Europe and America, the Indian Science Congress instituted a sub-committee on Science and Social Relations at its annual session held in Lahore in January, 1939. This sub-committee has been working for the last three years and its labours have fructified in the above proposal which in due course will come before the Indian scientists and to which they will have to give their most careful consideration.

The proposed Academy should be a body of high academic standing and professional knowledge, which can take up long range problems of social well-being of the people of India which the older Societies and Associations, established along familiar but too general lines in some cases and rather over-specialized lines in others, cannot deal with without suspicion of religious or political bias. Socio-medical and political subjects, human relations, anthropology, political science, vital statistics, social biology, population problems, sociological research in particular bearing on

various Indian communities are the subjects on which such an Academy can work in collaboration with the Indian Science Congress and half a dozen other institutions already existing in the country for some of the above-named specific objects. It can be a living organ in the body politic of India for voicing the collective opinion and focussing the specialized points of view of numerous isolated working bodies on the one problem, how to promote the well-being of the common man. The sub-committee has begun a survey of the status of sociological studies in all the Indian Universities. Vice-Chancellors of many Indian Universities have endorsed the proposal about the Academy favourably, and the secretaries of those learned societies that have been approached have announced their readiness to cooperate. Dr. K. Motwani, the Secretary of the sub-committee, personally placed the scheme before Pandit Nehru last July and, in accordance with Pandit Nehru's wishes, the Executive Committee proposes to appoint a Committee of Experts to suggest ways and means of bringing this Academy of Social Sciences into being. The matter rests here. It is too early to outline the exact task to which the Academy will address itself. Its chief function will be to explore those avenues through which the contributions of Science may be adapted to the life of the individual and the nation without allowing any anti-social applications of Science such as have made a shambles of so many countries, ever raising their heads in our midst. Secondly, the Academy should emphasize an integrated synthetic approach to every problem, pressing into service the contributions of various basic Social Sciences, such as Human Geography, Anthropology, Psychology, Economics, Political Science, Philosophy and Sociology. The bringing into being of a National Academy so constituted may well become a crowning achievement of the Indian Science Congress.

DO YOU KNOW ?

Q1. Name a bird that can not glide ?

Q2. Approximately how many feathers a swan has ?

PHOSPHORESCENT PIGMENTS : OPPORTUNITIES AND CHALLENGES

Prakash Chander Thapliyal*

Phosphorescent pigments are some of the special effect pigments. These have become of great interest as new functional pigments of high potential in diverse areas. The aim of this article is to take a closer look at phosphorescent pigments. Some new approaches in the development of novel pigments and their applications have been discussed based on the current research and existing products.

INTRODUCTION

Phosphorescent pigments are speciality pigments and often known as after-glow pigments. Phosphorescence comes under the broad term 'luminescence' meaning the emission of radiation as a result of process other than thermal emission or incandescence. Luminescence includes fluorescence, phosphorescence, triboluminescence and chemiluminescence (Table 1). Fluorescence and phosphorescence are the processes of absorbing energy in the form of electromagnetic radiation and emitting at least a portion of that energy as radiation. We are generally interested only in those pigments that emit in the visible portion of spectrum. Several criteria were used in the past for differentiating between fluorescence and phosphorescence. Fluorescence, for our purpose, refers to the emission that ceases as soon as the excitation ceases, while phosphorescence is the emission that continues even after the excitation ceases. These two phenomena are quite distinct, although closely related. A substance may be fluorescent but not phosphorescent or vice versa, whilst some substances like zinc sulfide are both phosphorescent and fluorescent. Phosphorescent materials found applications in optical and thermal uses, scintillation films, paints, inks and plastics, security applications, probe compounds and emergency source of illuminations, thermoplastic polymers and in temperature detection. Electronic price tags, flexible computer screens and disposable cell phones are among the other potential applications. Phosphorescent paints can be used under blackout conditions and as fire safety signs[1-2].

Table 1 : Different Forms of Luminescence Pased on the Source of Excitation

Luminescence type	Excitation source	Application
Cathodoluminescence	Electron	TV sets, monitors
Photoluminescence	(UV) Photons	Fluorescent lamps, plasma displays
X-ray luminescence	X-rays	X-ray amplifiers
Electroluminescence	Electric field	LEDs, EL displays
Sonoluminescence	Ultrasound	
Solvatoluminescence	Photons	Detectors, analytical devices
Chemoluminescence	Chemical reaction energy	Analytical chemistry
Bioluminescence	Biochemical reaction energy	Analytical chemistry
Triboluminescence	Mechanical energy	

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TYPES OF PHOSPHORESCENT PIGMENTS

Quite a large number of inorganic compounds have been found luminescent. These consist of sulfides, oxides, silicates, tungstates, titanates and selenides. Silicates and tungstates are largely used in luminescent lamps, while for paints normally sulfides and oxides are used. Many organic dyes, both natural and synthetic, exhibit the property of luminescence but only in certain concentrations and are used after absorption on suitable carrier matrix. Phosphorescent pigments include the following :

(i) **Inorganic materials** : (a) Aluminates of rare earths e.g. La, Ce, Tb etc. and alkaline earths e.g. Sr. Ca etc[7-12]. (b) Sulphides of alkaline earth and transition metals e.g. Ag doped ZnS, CdS etc[10]. (c) Mixed halides, carbonates and borates e.g. barium europium flouro bromide etc[10]. (ii) Organometallic complexes like ruthenium dipyridine phenenthroline complex etc. (iii) Organic polymers like aromatic polyimides, polyalkylthiophenes, etc. (iv) Radioactive materials like radium, mesothorium, etc.

THEORY OF LIGHT EMISSION

When a pigment absorbs energy, a portion of that energy may be released in the form of light. This light is radiated when molecules and atoms have their electrons excited to such a state that they begin to loose energy in the light particles called photons. It can be divided into two categories depending upon the type of source : (i) Incandescence : When heat or thermal energy causes electrons to release photons. (ii) Luminescence : When chemical, electrical or light energy excites electrons.

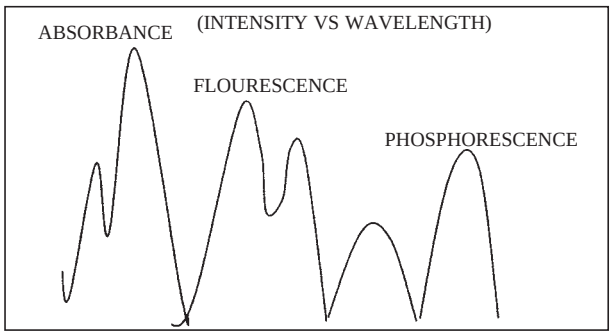
There are two basic laws for the excitation of phosphors. First, the material must absorb radiation and exciting radiation must fall within an absorption band of the material. Secondly, the emission must obey Stoke's law, which states that emitted radiation can't have a shorter wavelength than exciting radiation. Generally, luminescent materials emit at longer wavelengths than the exciting light. The process of absorption of energy is helped by addition of activators like silver etc. Phosphorescent material can trap the energy emitted and thus result in delay in light emission. Killer materials like iron, copper, etc. interfere in this absorption-emission process and hence for this very reason, the purity and cleanliness have been overemphasized during the synthesis.

With the help of Jablonski's diagram, it can be explained what happens within the molecules during luminescence (Figure 1). The various photo physical processes can be summarized as :

$S_0 + hv$	$\rightarrow$	S_1^v	EXCITATION
S_1^v	$\rightarrow$	S_1 + heat	VIBRATIONAL RELAXATION
S_1	$\rightarrow$	$S_0 + hv$	FLUORESCENCE
S_1	$\rightarrow$	S_0 + heat	INTERNAL CONVERSION
S_1	$\rightarrow$	T_1^v	INTERSYSTEM CROSSING
T_1^v	$\rightarrow$	T_1 + heat	VIBRATIONAL RELAXATION
T_1	$\rightarrow$	$S_0 + hv$	PHOSPHORE-SCENCE
T_1	$\rightarrow$	S_0 + heat	INTERSYSTEM CROSSING
$S_1 + A_{(so)}$	$\rightarrow$	$S_0 + A_{(s1)}$	SINGLET-SINGLET TRANSFER (PHOTOSENSI-TIZATION)
$T_1 + A_{(so)}$	$\rightarrow$	$S_0 + A_{(T1)}$	TRIPLET-TRIPLET TRANSFER (PHOTOSENSI-TIZATION)

Among the above photo physical processes, fluorescence and phosphorescence are radiative processes, while internal conversion and intersystem

crossing are non-radiative processes involving loss of heat. Intensity of phosphorescence is low in comparison to fluorescence but occurs at longer wavelengths. Here, we are excluding the discussion on photochemical processes i.e. excited molecules undergoing bond cleavage, chain scission, cross linking, cyclization, cycloaddition and oxidation. Emission characteristics for typical pigments are shown below :



SYNTHESIS OF PHOSPHORESCENT PIGMENTS

Synthesis depends on the type of pigment, whether inorganic, organometallic, organic or miscellaneous. Essential requirement and also the principal problem in the synthesis of luminescent pigments, especially the phosphorescent, is the purity of compounds. Phosphorescence is produced by presence of base material of selective impurities called activators. Activators must be present in right quantity because if there is too little or too much activator, the pigment will not be phosphorescent. In addition to the requirements about purity and proper activator addition, the material must be properly muffled to develop correct crystal conformation or again it will not be phosphorescent.

The phosphorescent materials are prepared by stirring the pigment into a suitable vehicle. Grinding must be avoided and also contact with moisture must be avoided at all costs. Greater care must be taken if organic dyes are used in the selection of solvents, which may attack the carrier or cause the dye to bleed. Principal weaknesses of organic phosphorescent materials are their tendency to fade on exposure to light.

As compared to the inorganic materials, organic phosphorescence materials are much more intense and less energy is required to excite and this is a very practical advantage. If further developments can improve the durability, these organic materials will have considerable influence on the designing of phosphorescence systems for the building applications during emergency.

There are basically two routes to the synthesis of phosphorescent pigments. First, solution chemical synthesis techniques like hydroxide precipitation, sol gel synthesis, etc. Secondly, solid-state reaction techniques like conventional high temperature synthesis and rapid exothermic reactions. The last type includes combustion synthesis of oxides and solid-state rapid metathesis reactions of sulfides.

APPLICATIONS OF PHOSPHORESCENT PIGMENTS

Phosphorescent coatings offer a promising field for the future development of finding systems and interior decoration in case of emergency. Recent great advances comprise the development of these pigments and coatings from the point of improving both the durability of the after-glow and the retention of the luminous property for long periods of use. These phosphorescent pigments are used in the following and many other related areas : ● Paints, lacquers & fabrics, ● Emergency lights & lamps, ● Colour television screens, ● Dials of watches & compasses, ● Protective equipments like helmets, gloves etc., ● Light emitting devices & Sensors.

CONCLUSIONS

The phosphorescent pigments have unique position in the materials family. Phosphorescent pigments can easily be modified for the applications in diversified fields including the building

applications and CBRI Roorkee is engaged in the R & D work of phosphorescent pigments[11&12]. In this review, an attempt was made towards increasing the understanding, importance and applications of phosphorescent pigments. Still, more efforts are needed from both the researchers and the industrialists to popularise the phosphorescent pigments.

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DO YOU KNOW ?

Q3. Air pollution in different parts of Kolkata has been measured by various agencies during normal days as well as during 'Bandhs' when city streets have no vehicular traffic. The idea is to estimate the contribution of vehicular traffic on air pollution. How much is that ?

Q4. There are two elements which are injurious to human health but when combined those become absolutely necessary ingredient of human food. What are those elements ?

TSUNAMI MITIGATION IN ANDAMAN & NICOBAR ISLANDS : A COMPREHENSIVE APPROACH

J. B. Kshirsagar*, Pawan Kumar*

The coastal regions of Gujarat and Andaman & Nicobar Islands are two potential areas in India which are vulnerable to Tsunami. Even earthquake of magnitude 7 or more on the Richter scale may cause Tsunami in these regions. Comprehensive approach to tsunami mitigation requires design of tsunami resistant structures both in structural and non structural terms. Tsunami Early Warning System is required to alert the people, local authorities, etc. Recently, NASA has developed GPS Displacement Method by using Global Positioning System software to determine whether an earthquake is big enough to generate Tsunami. A specialized Disaster Relief Agency/ Quick Response Team should be set up to look after the dissemination of early warning, rescue operation, relief works, and initial rehabilitation works, etc.

INTRODUCTION

On December 26, 2004, an undersea earthquake near Banda Acheh triggered a tsunami which hit the Southern Group of Islands in Andaman & Nicobar like Car Nicobar, Nancowrie Group and Great Nicobar apart from Andaman group as well as the southern coast of India and destroyed many settlements all along the coast. It is reported that over 12,400 people died in India, many went missing and millions lost their homes and livelihoods. The impact of the tsunami also disturbed the coastal ecology and environment. In Andaman & Nicobar Islands, it was estimated that 10,000 Ha of agricultural land was lost and 354 Km. roads were damaged. 24 jetties, 85 schools, 34 primary health centres, 37 MW power projects and water supply in 257 villages were badly affected. The Government of India took various immediate relief measures just after the tsunami, some of these are listed here :

● Rescue of victims, ● Providing ex-gratia to victims, ● Construction of Intermediate Shelters, ● Opening fair price shops & counseling centres, ● Restoration of power supply, ● Construction of all weather roads, ● Restoration of water supply, social services, ● Providing employment, ● Boosting tourism and agriculture, etc.

Tsunami in History

Sl. No.	Period	Place	No. of Lives Lost
1	July 21, 365	Alexandria, Egypt	1000
2	1692	Port Royal, Jamaica	3000
3	1703	Honshu, Japan due to earthquake	5000
4	1707	Japan	30,000
5	1741	Japan due to volcanic eruption	1400
6	1753	Lisbon, Portugal (combined effect of earthquake and Tsunami)	50,000

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Sl. No.	Period	Place Lives Lost	No. of
7	Nov. 1 1775	Portugal, Spain & Morocco	
8	1783	Italy	30,000
9	1868	Chile and Hawaii	25,000 and above
10	August 27, 1883	Java & Sumatra (Karakatoa volcanic explosion)	36,000
11	June 15 1896	Sanrika, Japan	27,000
12	Dec. 17 1896	California	
13	Jan. 31 1906	Colombia	15,009
14	1933	Sanrika, Japan	3,000
15	April 1 1946	Hilo, Hawaii	159
16	May 22 1960	Along the coast of Chile	2000
17	March 28 1964	Kodiak, Alaska after the Good Friday Earthquake	131
18	Aug. 17 1976	Philippines	8000
19	Aug. 19 1977	Indonesia	189
20	July 18	Indonesia	540
21	Sept. 12 1979	New Guinea	100
22	Dec. 12 1979	Colombia	500
23	May 26 1983	Sea of Japan	100
24	July 17 1998	Papua, New Guinea	2000
25	Dec. 26 2004	Asian Countries	12,400 in India alone

The Government of India has approved a special package of Rs. 3,452 crore for reconstruction work to be undertaken in Andaman & Nicobar Islands and construction of 8,566 dwelling units at a cost of Rs. 738.00 crore. CPWD will construct 7500 houses of which 6500 houses would come in Nicobar groups of islands. The designs for the dwelling units have been drawn up in consultation with the beneficiaries/village captains. NGOs were invited to actively participate in the reconstruction program.

PERMANENT SETTLEMENTS

Town Country Planning Organization (TCPO), Ministry of Urban Development, Govt. of India was assigned the task of preparing permanent Settlement Plans at 72 locations in various islands. TCPO teams initially visited some locations for reconnaissance to identify sites for new locations for permanent settlements based on the parameters and criteria derived like height above sea level, distance from original settlement, land form, availability of linkages, water, etc. They interacted extensively with the local administration / village captains / pradhans before finalizing sites for development.

The teams also took part in the interactions with the beneficiaries of the reconstruction programme and ANI Administration at Hut Bay (Little Andaman), Car Nicobar, Chowra, Teressa, Nancowrie, Katchal and Campbell Bay (Great Nicobar). Building designs, materials, layout plants, etc. were discussed with the people and their views were considered before finalization of the layout plans and Dwelling Unit design. The Layout Plans for Permanent Settlements in A & N Islands are taken up in accordance with current town planning norms and that these settlements come up as model townships, catering to the requirements of all facilities and amenities like schools, shopping centre, health centers, open spaces. Govt. and Semi Govt. establishments, etc. The Plans also take into account the topography, socio-economic characteristics, forest resource, etc. and above all are responsive to the needs and requirements of the local community.

Proposed location of new settlements being away from coast on higher ground will have enough scope to regenerate eco bio-shields in Little Andaman, Great Nicobar and other southern group of Islands. Similarly, areas measuring 500 m to 1000 m wide are proposed to be exclusively used for re-plantation of coconut which was extensively damaged due to tsunami. Table 1 summarises the material specification of dwelting units.

Table 1 : Material Specifications of Dwelling Units

Sl. No.	Components	Materials
1	Structure	Fabricated Steel Structure
2	Walls ● External Walls ● Kitchen Walls	 Timber Planks Paneling Light Weight (Aerated) Concrete Blocks 200/100 mm. thick
3	Internal Partitions	Processed Bamboo Board
4	Flooring	C. C. Flooring
5	Doors & Windows	Processed Bamboo Board/ Bamboo Jute composite
6	Roof	C. G. I. Sheets

For locations other than Car Nicobar, plot size of 20 m × 12 m (Twin D. Us.) is provided with front, rear and side sets back to ensure adequate light and ventilation and also to cater future expansion. 6 m and 3 m access roads are proposed according to requirement and site conditions. The Layout Plans are based on the cluster concept and include provisions for rainwater harvesting pits and garbage dumps. For Car Nicobar, the beneficiaries have asked for a house on stilts which are being provided. Attempt has been made to accommodate as many dwelling units in each *tuhet* (joint family) depending on land availability. For *tuhets* having large number of familes, more than one site has been selected for sitting dwelling units. Similarly, *tuhets* having few families have been merged and sited at one place to avoid any further clearing land.

TSUNAMI PREPAREDNESS

Planning for tsunami prone areas and design of tsunami resistant structures require both structural and non-structural measures to mitigate the effects of tsunami with preventive design solutions. It also requires a long term and sustainable plan of development.

Land Use Planning : Designation of land used from tsunami / cyclone prone to tsunami / cyclone resistant is required. Existing zoning and other regulations need to be reviewed and updated in context of tsunami. It is desirable to take up development at a safe distance from the coast line.

Location : Location of settlements requires thorough analysis of distance from the sea, elevation above MSL, height of high tide line, maximum run up of tsunami above the site elevation, expected depth and speed of tsunami waves, etc.

Protection of Existing Structures and Infrastructure : This requires proper assessment of structural and non-structural elements, adoption of adequate techniques such as repair, retrofitting, re-strengthening, replacement, etc. for protection of existing structures and restoration of infrastructure and facilities.

Tsunami Resistant Design : There is urgent need to frame tsunami resistant design code and its mandatory provision in local building bye laws. The code may fulfill various safety measures under multi hazard environment by adopting light weight construction.

Spcial Provisions : Tsunami is associated with phenomenon of inundation, currents, drawn down force, hydrodynamic forces, speed of waves, wave forces, etc. Hence specific provisions such as afforestation, ditches, slopes, etc. to reduce speed to tsunami waves, angled wall to deflect tsunami waves, stilted building, etc. are required. Additionally, bio shielding to protect low lying areas is also required to be adopted.

Evacuation Planning : It is an important part of tsunami planning. It requires awareness among residents about evacuation routes and areas. Horizontal evacuation includes provision of high ground, man made mounds, opens space on natural monds, etc. and vertical evacuation requires high rise buildings, proper connectivity between higher floors, etc. Hence, a comprehensive approach should

be adopted for evacuation and tsunami resistant building design. Similarily, Tsunami Emergency Plan for A & N islands and various safety measures may be spelt out in advance if airports, helipads and landing grounds are damaged.

An Interim Early Warning Centre is already operating at Indian National Centre for Ocean Information Servics in Hyderabad. The centre received earthquake and tsunami advisories from India Meteorological Department, Japan Meteorological Agency, and Pacific Tsunami Centre as well as data from tide gauges in India and abroad. Based on these, the centre was able to confirm the origin of earthquake near Indonesia and followed by tsunami on July 17, 2006. However, a proper system of dissemination of warning to the local authorities and people is required.

MEASURES RECOMMENDED

Coastal building should be designed to with stand tsunami wave pressures. At present, no tsunami code exists and hence these need to be developed. Bio-shielding to protect low lying areas is required. Light weight construction that may be constructed in one or two days is required to be adopted. The buildings should be circular to ensure that water easily flows around.

The use of GIS and aerial photography are necessary for mapping and these maps should be made available to local administration for urban planning on 1 : 1000 scale having contour of 1-2 m interval.

Tsunami is quite common in the Pacific Ocean, less so in the Indian Ocean and least common in the Atlantic Ocean. However, Tsunami Early Warning System is required to alert the people, local authorities, etc. The Govt. of India is setting up an Early Warning System for Tsunami and Storm Surges in Indian Ocean at a total cost of Rs. 125 crores. Additionally, a Centre would be set up at the Indian National Centre for Ocean Information Services, Hyderabad on 24×7 basis. The system is scheduled to be operationalised by September, 2007. It will be Tsunami Warning System for the whole country.

India also intends to install a network of 50 tide gauges. In the first phase, 14 tide gauges had been installed by the Survey of India and the National Institute of Ocean Technology. The remaining 36 are to be installed and made operational by March, 2007. A dozen deep ocean assessments and reporting systems are to be installed, 10 in the Bay of Bengal and two in the Arabian Sea. Each system consists of a bottom pressure recorder that was installed on the ocean floor to detect any increase in the height of the water column above it. The information is then relayed to an ocean buoy, which would transmit the data to shore.

Recently, NASA has developed GPS Displacement Method by using Global Positioning System software to determine whether an earthquake is big enough to generate tsunami. This technology can be used to provide faster tsunami warnings. This new method works by measuring the time radio signals from GPS satellites arrive at ground stations located within few thousand kilometers of a quake. From these data, scientists can calculate how far the stations moved because of the quake. An earthquake model and its true size that is called moment magnitude can be derived. This magnitude is directly related to a quake's potential for generating tsunami.

A specialized Disaster Relief Agency / Quick Response Team should be set up to look after the dissemination of early warning, rescue operation, relief works, and initial rehabilitation works, etc. It should take specialized advice of the agencies such as Geological Survey of India, MHA, Meteorological Dept. etc. in preparation of pre-tsunami plan and post tsunami evacuation and relief strategies.

FAIRNESS PRODUCTS–BLESSING OR CURSE

Bijaya Ghosh*, Uma A. Patil* & Jhuma Deb*

The obsession of Asians towards skin fairness has led to an increased usage of fairness products. However, the consumers of such products have little knowledge about the chemicals used in these and the mechanism by which they work. It has been scientifically proved that some of the ingredients used in these products can cause irreversible damage to the skin and even damage its texture. But the publications of these adverse effects have not reduced the usage of these products. In contrast, the market has responded by introducing special products that are claimed to be safe and are publicized to be of natural origin. The article discusses the science behind skin pigmentation and the mechanism of the cosmetics used to manipulate it along with their medical repercussions.

INTRODUCTION

Asian communities have always placed fair skin as one of the criteria for beauty. "Fair is beautiful" is ingrained in Indian psyche too. But, presently, this innocuous obsession is turning into a major economic and health issue. Commercial houses are marketing a special range of products using the word fairness in the label. Scenario has changed so much that every product that uses the word "fairness" is witnessing phenomenal growth. Whereas the overall Indian economy is aspiring to a growth rate of 6-8%, the fairness products are experiencing a growth rate of nearly 40% annually. Since overall cosmetic Market is growing at a rate of 15%, the other industries are invading the cosmetic arena to slather the customers with all types of fairness products.

THE FAIRNESS PRODUCTS MARKET

The craze started in 1975, when the first fairness cream appeared in the market. The product promised the dark-skinned ladies the fairness of skin and became almost an essential possession of every woman. The result prompted many more to enter this assured market and at present there are seven main brands of fairness products making headlines in the advertising media across the country. Moreover, there are many more available in the regional market with little publicity; the market seems to have a place for everybody.

Fairness has universal appeal and Indian products were priced in the affordable range of the middle— and the low-income groups. The globalization changed the scenario drastically. It made way for the invasion of foreign compaines and hyped with publicity, the exclusive high cost cosmetics started entering into the middle class household.

SCIENCE BEHIND THE SKIN COLOUR

The colour of the skin of an individual is decided by heredity. The pigment, melanin, that makes skin dark is produced by a complicated process. Melanocytes, producers of melanin, exist in the deeper layer of skin. There a chemical called tyrosine is first converted to DOPA, which couples with the protein to form melanin. Next, the pigments are loaded in minute bodies called melanosomes

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and get transported to the keratinocytes, which reside at the outermost layer of the skin. If a person produces melanin in high quantity and at faster rate, the skin will be darker[1,2]. Genes, an integral part of chromosome, which control the production rate of melanin are hereditarily decided. So it is understandable, to make skin fairer, the production process has to be intercepted at cellular level.

STRATEGIES TO ACHIEVE FAIRNESS

- Selectively destroying melanocytes—production machinery is destroyed.
- Inhibiting the biosynthesis of tyrosinase—cutting off the supply of raw material DOPA.
- Inhibiting the formation of melanin—stopping the conjugation of DOPA with protein.
- Inhibiting the formation of melanosomes and altering their structure—melanin is formed but their packaging is inhibited.
- Interfering with the tranfer of melanosomes—interfering the distribution of melanosomes.
- Enhancing degradation of melanosomes in keratinocytes—destruction of the colouring pigment at the skin surface.

FAIRNESS STRATEGY OF CONVENTIONAL BLEACHING AGENTS

Analysis of the scientific information reveals that to achieve fairness, one needs to manipulate the normal functioning of the skin, which is controlled by the genetic expression. Hence, attempts to produce fairnes by interfering with the normal functioning of the melanocytes are not a research priority. Even if a miraculous compound is discovered, there is no guarantee that it would selectively target the melanin formation leaving the essential physiological processes undisturbed. The commercially available fairness products are meant for surface application and intended to exert their effect on the superficial layers only.

Some of the popular fairness agents can be divided into the following categories :

Mercury-containing cosmetic preparations **:** Though the success rate was variable, mercury compounds have been traditionally used to lighten the skin. They are believed to alleviate the age related brown spots as well as freckles. The mercury ions inhibit tyrosinase activity and thus inhibit the synthesis of melanin[3]. These compounds also cause desquamation of the skin by the peeling off of the outermost layer.

Hydroquinone : An effective bleaching agent, it controls the formation of melanin by blocking the enzyme tyrosinase. Results of animal experiment confirm that hydroquinone cause reversible depigmentation of the skin and hair of mice, guinea pigs and humans by a complex mechanism of action. At the cellular level, hydroquinone and its derivatives are oxidized by tyrosinase to form highly toxic free radicals that cause selective damage to the lipoprotein membranes of the melanocyte, thereby reducing conversion of tyrosine to DOPA and subsequently to melanin.

Since hydroquinone prevents the formation of only new melanin, its bleaching effect is delayed. However, at a concentration of 4% it can provide results in as little as four weeks. The effect of Hydroquinone is far reaching as it kills the melanin making cells wherever applied and is associated with a high success rate (60-70%). The efficacy of the preparation has made it an extremely popular product among the Africans where about 75% of the population uses these products.

Monobenzyl ether of hydroquinone (MBEH) or monobenzene : MBEH is usually reserved for generalized de-pigmentation in patients with extensive vitiligo. It is selectively taken up by melanocytes and metabolized into free radicals that can destroy them permanently. Unlike hydroquinone, it causes irreversible de-pigmentation, even upon cessation of use. The

process requires 9 to 12 months of continuous daily application to achieve complete de-pigmentation[4].

Hydrogen Peroxide : The acidic property of hydrogen peroxide is extensively used for the bleaching of facial and body hairs. To stabilize the hydrogen peroxide, the pH values of the creams are usually adjusted to 3.5–4.0. An activator substance (ammoniated bicarbonate) is mixed with the cream just before application that reacts with phosphoric acid to liberate the hydrogen peroxide, which causes bleaching, by oxidation.

Table 1 shows the common problems associated with skin lighteners.

Table–1 : Problems Associated with skin Lighteners

Mercury derivatives	Neurotoxic problems such as ataxia, speech and hearing impairment; mental problems such as irritability, fearfulness, and depression; kidney problems such as mercury-induced nephropathy; and immunotoxicity
Hydroquinone preparations	Ochronosis, a blue-black discoloration caused by deposits of ochre-colored pigment. Hyperchromia, presence of red cells with abnormally increased cell hemoglobin count. Hypochromia, presence of cells with abnormally low cell hemoglobin content. Neuropathy, disease of the nervous system.

INGREDIENTS OF HERBAL FAIRNESS PRODUCTS :

Thanks to the scientific investigations, awareness has been generated about the damaging potentials of chemicals used in fairness products. Ironically, it has made way for a group of companies who entered the market with claims of products containing safe natural agents. Safety conscious customers are the target buyers of these high cost special products, which usually contain an assortment of the herbals whose precise mechanism of action is not fully explained.

The information leaflets usually mention the name of herbals but not the active ingredients or their concentrations. Since the nature and quantity of the chemical constituents of the natural products vary widely depending on the source, in absence of standardization, the concentrations of the active ingredients are likely to vary. However, the fairness claims of some of the herbals have been scientifically justified, but it also shows that the so-called chemical-free herbal products actually exert their fairness effect by virtue of certain chemicals only.

(i) ***Bearberry plant (Arctostaphylos uva-ursi)*** **:** It contains Arbutin—a hydroquinone glucoside. The active component hydroquinone, is relased by the hydrolysis of the glucoside fraction. Since this is a slow process, the use of Arbutin may be less irritating than the use of hydroquinone directly. Arbutin, an inhibitor of melanin production, is often used in skin care products as a soothing agent[5].

(ii) ***Pityrosporum ovale*** **:** Azelaic acid, a C9 dicarboxylic acid responsible for its bleaching property, is isolated from the cultures of *Pityrosporum ovale*. It acts as a competitive inhibitor for tyrosinase *in vitro*. It does not affect normal melanocytes and hence does not produce any significant therapeutic effect in normal skin. Hence, its use in normal skin has no rationale. Commercially available as Skinoren, azelaic acid has been used to treat melasma and post-inflammatory hyper pigmentation at concentration of 15% to 20%. It has been used in combination with 15% to 20% glycolic acid or with tretinoin to increase its efficacy[6]. Azelaic acid is relatively non-toxic. The most commonly

reported adverse symptoms are transient stinging and itching that subside within 2 to 4 weeks.

(iii) ***Tretinoin*** : It works by a unique mechanism. After formation, the pigments are transported to the outermost cell layer, which gives the coloring effect of the skin. Tretinoin acts by increasing epidermal cell turnover, reducing the contact time between keratinocytes and melanocytes, and promoting rapid loss of pigment through epidermopoiesis. Its skin lightening effects are observed between 12 and 44 weeks of initial therapy. Some patients experience moderate erythema and desquamation following its use.

(iv) ***L-ascorbic acid*** : It inhibits the production of melanin by interfering with its synthesis. It can reduce oxidized melanin and alter melanin significantly. However, being chemically unstable, its preservation in a multi-ingredient product is a challenging job. In aqueous solution, it becomes oxidized very quickly.

(v) ***Kojic acid*** **:** Naturally obtained Kojic acid is a fungal metabolite which is a potent inhibitor of tyrosinase activity. It is also an anti-oxidant. It can be used alone (1% to 4% cream base) or together with hydroquinone, tretinoin or a steroid. It appears to have synergistic with glycolic acid. Data regarding its long-term safety are still unknown. However, a high incidence of contact sensitivity has already been reported[7].

(vi) ***Licorice (Glycyrrihiza glabra)*** **:** Contains glycyrrhetinic acid, is used in the cosmetic industry for its skin whitening quality. The de-pigmentation property of licorice is due to its ability to inhibit the tyrosinase activity of melanocytes[8]. Topical application of 0.5% licorice has been demonstrated to inhibit UVB induced pigmentation and erythema.

(vii) ***Glycolic acid*** **:** This alpha hydroxy acid (AHA) is used as a chemical peel to reduce fine wrinkling when applied as a 50-70% solution, but it can reduce pigmentation in the skin also after the peeling process subsides. Multiple creams and lotions are available that contain lower concentrations of glycolic acid, often in combination with other skin lightening agents and moisturizers. It is also used in the treatment of acne. Glycolic acid in excess of 5% can cause skin irritation, scaling, redness and itching.

SOCIO-ECONOMIC AND MEDICAL REPURCUSSIONS

The innocuous obsession of looking fair and bright with the help of fairness creams is now having far reaching socio-economic and medical repercussions in India[9]. The problem becomes more complicated in orthodox societies where women are prone to keep their personal habits away from the glare of investigation. There are instances where, in spite of suffering serious side effects, people were not enthusiastic in a medical solution.

The delayed appearance of the side effects and their similarity with the known disease patterns make the matter more complicated. Sometimes patients, because of psychological reasons, mislead the physicians by giving false or incomplete information about the habit of cosmetic use. Globally, 69% of the consumers suffer from at least one complication, but it has not reduced the growth of the fairness industries go unabated.

The mercury compounds have always been known to be unsafe. But, companies give inadequate information about their side effects. Mercury is a potent allergen and can be readily absorded through the unbroken skin and reach lungs by inhalation. There are reports of its accumulation in the body and occurrence of severe unwanted reactions after its chronic use. A cost benefit ratio of the mercury containing fairness products is yet to be documented. The Food and Drug Administration is yet to come up with well-established guidelines to document the effectiveness of these preparations.

Medical researchers have established that 70% of patients, who use skin creams containing high amounts (4% or more) of hydroquinone (HQ) for an extended period of time (one-three years), develop exogenous Ochronosis". This disorder is characterized by progressive darkening of the area to which the cream containing HQ is applied. Histologically, degeneration of collagen and elastic fibers occurs which is an irreversible disfiguring cosmetic problem. The continued use of HQ based skin bleaching products leads to a progressive discoloration of the skin.. Clinical and Laboratory investigations have also confirmed that concentrations greater than 5% have been associated with persistent hypo-pigmentation and are not recommended. Combination of HQ with other lightening agents as tretinoin and glycolic acid may be synergistic. It is unknown if hydroquinone passes through the placenta, so most dermatologists do not recommend its use during pregnancy or lactation. FDA had approved the use of 2-4% Hydroquinone for bleaching purpose, but the occurrence of the effects typical of the higher concentrations indicate that the business houses had taken liberty, with the legal restrictions, in the use of this harmful active ingredient.

CONCLUSION

The cosmetics, which are applied on the superficial layer of the skin, should be subjected to strict regulation because skin is no more considered as a dead inert membrane[10]. Skin is permeable to the small molecules (< 500 daltons) and can elicit strong immunological reactions because of the presence of an organized immune system in its deeper layer which causes allergy. Sometimes the chemicals applied on the skin can penetrate deep inside and cause systemic effects too.

As the use of skin lightening cosmetics is prevalent in both Asian and African countries and growing exponentially, awareness should be created about their potential to cause adverse effects. The fresh herbals like lemon, turmeric, etc., were traditionally used for bleaching purposes but had never shown any toxic effects. Considering the cost of the advertisement hyped herbal products, the use of these fresh herbals would be much more practical and economic in a third world country like India.

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TECHNOLOGY TRANSFER : A COMPLEX BUT NECESSARY PROCESS

Smita Verma*

Technology transfer is a process which can strengthen the core of an enterprise's productivity. It is required to increase competitiveness, win new markets and create new jobs. It is the need of today for every industry to accept the technology transfer process to keep the pace with competitors and time.

A fast track way to provide growth is technology transfer which is a process which can strengthen the core of an enterprise's productivity, its technological capital. There are, however, many pitfalls and there is more to technology transfer than simply a desire to achieve it. Research has shown that technology transfer is a complex subject with many interrelated aspects. The practical experience is extremely valuable in this respect and without people and human factor there is no technology transfer.

Enterprises need to innovate, to integrate the best technologies and most effective management practices. In technology transfer it is not merely to bring together a supplier of technology and a potential end-user, many other factors, not least the human dimension, need to be taken into account. The technology validation and technology transfer projects are highly instructive.

Technology transfer can be a vital link between financial optimization, human resource management and marketing. Introducing a new technology can be ifself e a way to become more competitive, but the adoption of new technology is also closely linked with every other aspect of the enterprise. Actually, technology transfer is adoption of technology by a company in an area where it has not previously been applied. Today, from information technology to biotechnology, economic growth continues to be based largely on the incorporation of new technologies by every sector of the economy and by every business. This is why it is so important to understand and manage technology transfer.

In earlier times, technology transfer was seen as a simple process of moving research results from research to business, sometimes through an intermediary and with some adaptation. As there are now many methods of technology transfer, a partnership between diverse industries, the process has become more complex. For example, an inventor might have to deal with a large enterprise and this may cause problems with the balance of power. A large laboratory may hesitate to pass its discoveries into a small business, preferring to deal with the multinationals instead, not always the best move. These examples highlight the cultural difference between public and private sectors that can lead to friction. However, many scientists and industrialists have overcome these problems to work together on multipartner projects.

The human factor is essential in the integration of new technologies into an enterprise. A 'social consensus' amongst the work force is needed to overcome the resistance of employees who see their traditional working practices challenged. Training and organizational changes are vital.

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To this end, intermediary structures such as trade associations, trade unions and training establishments play an important role in technology transfer. This type of programme had earlier been underestimated, but it is now valuable in projects.

The ability of a business to produce technological innovation naturally depends on its attitude towards a range of technologies. Enterprises can easily be classified into three ways according to their approach to technology. These classifications make it easy to draw conclusions about a company's suitability for involvement in technology transfer. The first category 'machine enterprises' are basic technological trades with a rigid and centralized management style. Enterprises of this type were very successful during the last century and until the Second World War. Although these enterprises make good use of information technology, they tend to focus on their core businesses in a traditional way.

The second category comprises 'portfolio enterprises'. This type of enterprise manages technology principally at the level of Research and Development, while business operations are driven by financial and market information. Short term management models may be a determining factor, and these can damage well conceived technological efforts. Finally, there is a 'network' category of enterprises. Network enterprises rely on an overall strategic vision which is based on technology, particularly in technological information and communication systems.

For a fast track expansion of technology and innovation to be effective, economic, legal, regulatory and intellectual property barriers need to be dismantled. This dismantling process should be supported both in organizational and human terms. Information also plays a vital role. A general classification has been drawn up which explains the typical technology transfer scenario to help people understand the many ways in which technologies circulate. Different types of transfers have been classified. Sectoral transfer and Regional transfer.

In sectoral transfer, there is no reason why discoveries or inventions should be restricted to the sector in which they were made. On the contrary, solutions to problem in one sector are often innovations useful and applicable in other sectors. Practical experience shows that the technical content of a process is very important in cross-sector applications. The closeness or otherwise of the original sector to the new application is relatively unimportant. Sectoral transfer can operate from one high-tech sector to another. For example, a sensor developed for aeronautical purposes might prove very useful in nuclear engineering. The sophisticated research work carried out by drug manufacturers occasionally uses knowledge gained from traditional medicine. More often it is high-tech sectors, with their large research budgets and capacity to generate innovations, which can provide technological innovations to enterprises in traditional or low-tech sectors. Sector to sector technology transfers are quite common but they have their share of problems, including that are not related to technology.

One of the prime objectives of big firms reflected in sizeable budget allocations, is in social and economic cohesion. Another objective is region. Regions in industrial decline have an urgent need for technology transfer. These regions, once considered to have an industrial tradition, have undergone radical deindustrialization. For more than a century, economies of developed nations were dominated by steel working, mechanical engineering, shipbuilding, textile production and mining. These industries are slowly being replaced.

Businesses need the right environment to establish competitive working practices and a work force that can adapt to modern mangement methods. It is generally in these regions that the public authorities have shown themselves most willing to create structures such as innovations support networks, training centers and cross industry groups to simulate technology transfer. Finally, it is the need of time for every industry to accept the technology transfer process to keep the pace with competitors and time.

DIVERSIFIED PRODUCT OF JUTE AND MESTA

M. K. Sinha and S. C. Chakrabarty*

This article discusses the role and potential of diversified jute and mesta products for rejuvention of jute industry.

For more than a century, jute industry occupied a very important position in the national economy of India. However, in late 70's a serious jute imbroglio started and large number of mills closed down or are running at losses. The demand—supply gap, raw jute price fluctuations, synthetic substitutes and reliance on government sheltered demand contributed considerably to the present serious problems facing the jute industry. While the decreasing trend in demand of traditional jute products is inevitable, the emergence of non-traditional diversified jute products offers possibilities, to an extent, for rejuvenation of jute industry.

At present, export of jute products from India is worth Rs. 1,000 crores. Of this, 30% is earned by jute diversified items and the rest is from the conventional sacking, hessian and carpet backing sectors.

Thanks to WTO convention, sacking and hessian are gradually regaining the lost market. Current and future research should be strengthened on diversification and innovation of useful products made with jute and allied fibres. There is a strong possibility that jute composites and newsprints would open up wider scope of the golden fibre. The alternate uses of jute and mesta crops are presented in this article.

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ALTERNATE USES OF JUTE AND MESTA

(i) Apparel textile :

This needs comfortability to wear and should have aesthetic look, this calls for crop varieties with good quality. Fibre can be used for making jeans, safari suits etc. However, apparel textile needs special quality fibre. Jute fibre is coarse and somewhat brittle due to high lignin content and requires to be improved. In view of this, CRIJAF has taken up breeding work to develop varieties with optimum lignin and better quality (better fineness and strength) parameters. This apparel sector may usher in a big market in near future.

(ii) Technical Textile (Non-textile) :

Non-textile products have an attractive future. Such products would be using only coarse fibres currently produced in plenty and available at low cost.

(a) Home Textile :

Furnishing Fabrics, floor covering, soft luggage, wall cover, carpets, jute woollenised blankets and bags form bulk of this sector. Jute blended with polypropylene, needle punched non-polypropylene and jute in needle loom with special technique so that PP fibre can only be visible from the product surface while jute remains confined in the middle are expected to serve such purposes. In collaboration with National Institute for Research on Jute and Allied Fibre Technology (NIRJAFT), Ram Krishna Mission, Kamarpukur has established one plant for

this purpose. This is gradually gaining popularity among the farmers and entrepreneurs.

(b) Geo-Textile :

This has use in checking soil erosion, maintaining embankments and 'kutcha' drainage. It also helps protect newly constructed embankments of railways and roads. The best use is in mulching soil in agricultural fields. The advantages of jute Geo-Textile are its low cost, easy installation and availability in plenty. It absorbs large part of the kinetic energy of rain drops and controls rain splash detachment of soil particles. Thus, it acts as an effective soil stabilizer by providing reinforcement.

(c) Protective Textile :

Jute can be used to replace asbestos, false ceiling and door panels.

(d) In Horticulture :

Jute can be used for Horticulture purposes for making nursery set cover, tea and apple chests.

(e) Auto Textile :

Non woven jute can be blended with synthetic to prepare seat covers and cover for different car parts. Replacing glass fibre with lower-density natural fibre can slash the weight of some of the materials used in a car by up to 30% contributing to lower fuel consumption and less pollution.

The bio-based materials give improved safety because natural fibres absorb energy extremely efficiently in the event of side collisions and do not crack or splinter.

(f) Mobile low cost shelter :

Low cost pre-fabricated dwelling accommodation could help in disaster mangement, such as one faces after flood, earthquake and fire.

(g) Floor covering and insulation medium :

Needle punched jute/jute blended non-woven fabrics showed excellent thermal and sound insulation properties. These are substantially cheaper than woolen and synthetic materials.

(h) Handicrafts :

Different handicrafts can also be made from Jute for export purpose.

(iii) Paper Pulp :

The world demand for paper has been steadily increasing. Its consumption increased from 40 million tonnes in 1950 to 226 million tonnes in 1988 and the increase is to the tune of 4.71% per annum.

In India demand for paper is expected at 50 lakh tonnes. Jute and jute like materials could play and important complementary role in view of the depleting perennial forest.

At least 8 tonnes of paper pulp can be produced from one hectare of jute and kenaf. This will not only increase income of farmers but also help the country to be self reliant in paper pulp sector without hampering the environmental safety. Being an annual crop, jute has no adverse effect on environment. On the contrary, depletion of forest for paper manufacture is proving harmful as it disturbs ecological balance.

(iv) Super absorbent for Medical use :

Finely pulverized jute stick powder is good base for making absorbent pads used in hospitals. It is in use in making air-filters of cars.

(v) Food grade jute bags :

Cocoa and Coffee growers are demanding special jute bags which have a current market value of about Rs. 350 crores. Indian Jute Industry has up till now exported around 10 thousand tonnes of these bags.

(vi) Jute leaf :

Jute leaf has been in use as vegetable in West Asian countries, Sudan and Egypt. Bangladesh and

Thailand are now exporting jute leaves to Japan, Saudi Arabia and gulf countries. Besides use as a vegetable, jute leaves have medicinal properties, which are yet to be exploited by the pharmaceutical manufacturers.

(vii) Exploiting jute sticks :

Traditionally, they are being used for fuel but at present many entrepreneurs are utilizing them for making particle-boards and jute composites. This way, the price of jute stick has doubled from Rs. 1 per kg to Rs. 2 per kg by now. This will certainly fetch additional income to the jute farmers. Different uses of jute stick are as follows.

Particle Boards :

Jute stick, being lignocellulosic material like hard wood, is found to be a good substitute for the conventional plywood and bamboo particle boards and composites thus helping out in saving forest resources. Jute particleboards have wide applications in packaging (fruits, tea etc.), furniture, roofing and interior decoration as well.

A variety of products can also be produced from jute stick like oxalic acid, charcoal, viscose rayon, carboxymethyl cellulose furfura.

(viii) Jute fibre reinforced composites :

Using non-wovens made from jute fibre wastes as substrate and synthetic resin as matrix, waterproof, fire proof corrugated and plain sheets are prepared, to be used as false ceiling, roofing materials and partition wall and decorative items.

(ix) Reinforced plastic materials :

Reinforced plastic materials from jute and jute blends are on their way to evolve, as jute non-wovens could be used as replacements of glassfibre mats for reinforced plastic mouldings.

(x) Biogas production and mushroom cultivation :

On an average, 5-6% of the jute fibre processed in mills is dropped as 'caddis' i.e. un-spinnable very small fibres unsuitable for further use. This industrial waste can be used for biogas production and residual slurry mixed with rice-straw can even be utilized successfully for mushroom cultivation.

(xi) The calyx of Kenaf flowers :

The calyx of Kenaf flowers can be utilized for preparation of processed food products like jam, jelly, pickles and chutnies. Some cultures were identified for suitability in both the species of *Hibiscus sabdariffa* and *Hibiscus cannabinus* for the preparation of excellent pickles.

(xii) Seed oil :

The seed oil content of jute (12-14%) and Mesta (16-18%) can also be utilized for industrial oil preparation.

(xiii) Pharmaceutical aid :

Cellulose acetate is used as a tablet coating material. Carboxymethyl cellulose (CMC) is also used in cosmetic, toiletries and chemical Industries. These products developed from jute are the result of research carried out by Bangladesh Jute Research Institute (BJRI).

DO YOU KNOW ?

Q5. For crocodile eggs what is the difference if an egg is hatched above or below 87C.

Q6. How taste is related to smell ?

WASTE WATER TREATMENT

S. Bhattacharya, P. Kumar, H. D. Pandey*

BASIC TECHNOLOGY

An integrated steel plant requires a large quantity of water for various processes such as cooling, scrubbing, gas cleaning etc. In the Indian steel industry, specific water consumption varies in the range of 10-50m^3/tonne of crude steel. An approach to industrial waste water treatment must consider the problem in totality. An industrial waste water treatment scheme should aim to control the pollution at the source and /or at the ultimate disposal point. Accordingly, it could be either 'Inplant Control', or 'End of the Pipe Treatment', or both.

'Inplant Control' consists of measures which will reduce the waste water quantitatively and reduce the pollution potential qualitatively. This is achieved through adoption of appropriate technologies and recycling of effluents. 'End of Pipe Treatment' deals with treatment and disposal of waste water after the application of inplant control. The treatment process chosen depends on several factors : flow rate, waste-strength and toxicity, land availability, climatic conditions and discharge norms.

The waste water treatment comprises three stages, viz. primary treatment, secondary treatment and tertiary/post-treatment or final polishing. The primary stage is for the removal of suspended solids (SS), tar and oils. It can be achieved through neutralisation, coagulation, hydrolysis or floatation depending upon the type of contaminants. The secondary stage is for the removal of specific toxic constituents by adopting Activated Sludge Process (ASP), Trickling Filter (TF), Aerated Lagoons, or Root Zone Process etc.

Removal of phenol, cyanide and ammonia by Biological Oxygen Demand (BOD) process is a typical example of secondary stage treatment. The tertiary stage is for the final polishing of the treated water to meet the discharge norms and/or aesthetic requirements.

The various facilities installed for water pollution control in SAIL plants are shown in Table-1. The effluents generated in an integrated steel plant vary considerably with the nature of the process. Among these, the effluents from coke ovens (CO) are the most difficult to treat and are yet to have a standard treatment method. However, biological oxidation process has been adopted fairly widely. Some important aspects of this specialised treatment process are outlined in this article.

COKE PLANT EFFLUENTS

Coke oven effluents are highly toxic in nature

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and the volume handled is also large. It contains a wide variety of contaminants such as tar, oils, aromatics, cyanides, sulphides, free and fixed ammonia, thicyanates, thiosulphates etc. Among the various methods of treatment of these complex effluents, the biological oxidation process has been found to be the most economical and successful.

materials is, therefore, a pre-requisite. This involves gravity separation, sedimentation, decantation or use of gravel filters etc.

Primary treatment consists of ammonia stripping, neutralisation, equalisation and chemical conditioning (if necessary). Secondary treatment involves biological oxidation process in single or

Table I : Water Pollution Control Facilities in SAIL

	BSP	DSP	RSP	BSL	IISCO	ASP	SSP	VISL	MEL	Mines	Total
Thickeners/Setting Tanks	21	19	6	10	18	2	–	3	1	12	92
BOD Plants	1	1	1	1	2	–	–	–	–	–	6
Catch Pits	–	6	15	10	13	3	3	–	2	–	52
Neutralisation Units	–	2	3	4	1	1	1	–	–	–	12
STP/Oxidation Ponds	3	5	7	1	6	1	–	1	–	4	28
Miscellaneous (addition of special chemicals etc.)	–	2	41	12	8	3	1	1	–	–	68
Total	25	35	73	38	48	10	5	5	3	16	258

BIOLOGICAL OXIDATION PROCESS

This process uses the catalytic and metabolic activities of bacteria and other micro-organisms to convert the soluble and colloidal organic carbonaceous matters to carbon dioxide and new cells. The conversion is carried out by bacteria and the other micro-organisms in the bio-reactor.

INTEGRATED TREATMENT SCHEME

Treatment scheme for CO effluents may involve a pre-treatment step followed by primary, secondary and tertiary stages of treatment.

The major objective of pre-treatment of CO effluents is to make the waste water more amenable for treatment at subsequent stages. The presence of tarry materials, even in small amounts, may pose difficulties during later steps due to clogging of ammonia stripping columns or heat exchanger or inhibition of biological oxidation process. Thorough removal of suspended solids including tarry

multistages. Each stage is uniquely suited for bringing down levels of specific pollutants with the help of specially cultured micro-organisms. Tertiary treatment comprises final polishing which enables control of minor deviations from the discharge norms. The various unit operations involving all the three process stages are shown in Fig. 1.

DEVELOPMENTAL TRENDS

Process Technology

Improvements in Conventional Treatment Process

Various developments have taken place in all the three stages of treatment. In 'pretreatment stage', parallel plate separators are used for efficient removal of tar and oil. Dissolved Air Floatation (DAF) with coagulant and polyelectrolyte dosing has proved to be very efficient in removing suspended solids and emulsified oils.

During the 'primary treatment step', the removal of free and fixed ammonia to optimum levels can be enhanced by steam stripping at higher pH levels achieved by caustic dosing in ammonia still.

removal of pollutants. Both aerobic and anaerobic micro-organisms are active in the rhizosphere (first 60 cm below the top-soil) due to development of aerobic and anaerobic zones in the reed bed. Hence,

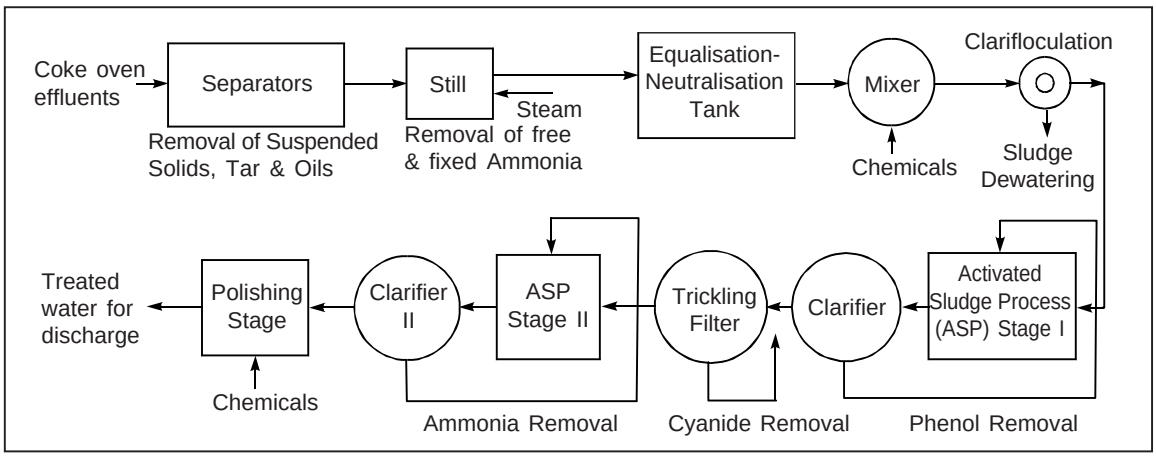

Fig. 1 : *Process flow diagram for coke oven effluent treatment*

During 'secondary treatment', removal of CN and NH_3 in the coke oven effluents has been matter of intense investigations. Multistage activated sludge (bio-oxidation) process have been evolved to solve the problem. However, the recent development of a single stage activated sludge process with very high Mixed Liquor Suspended Solids (MLSS) of 14,000-20,000 mg/I compared to conventional process having 5000-6000 mg/I coupled with high residence time has been found to be very efficient in meeting final discharge standards.

Developments in the use of ion-exchange resins, activated carbon, ozonation etc. are major development in the 'tertiary stage' treatment.

ROOT ZONE PROCESS : ALTERNATE TECHNOLOGY FOR COKE-OVEN EFFLUENTS TREATMENT

This novel process exploits the natural ability of phragmites reed to transfer large quantities of oxygen from the atmosphere to its root zones where bacteria in the soil accomplish biological

nitrification and denitrification processes occur together with the degradation of organics, thiocyanates and cyanides. However, availability of land may be a constraint in the adoption of this technology.

ENGINEERING AND DESIGN

In biological treatment, Sequential Batch Reactors (SBR), where operations are performed in sequence in the same reactor leading to increaed operational efficiency, may be of appropriate design in some cases.

Anaerobic bio-degradation of high strength industrial waste water has been successfully practised in sugar industries. However, coke oven waste water poses certain difficulties in complete bio-degradation by anaerobic route. A combination of anaerobic-aerobic bio-degradation has been tried with success. One of the drawbacks of anaerobic digestion is slow rate of bio-degradation. This shortcoming has been overcome by fluidished bed technique.

ENERGY CONSERVATION

Anaerobic bio-degradation of coke oven effluents results in generation of bio-gas which could be a source of energy. The anaerobic-aerobic combination of bio-degradation results in reduced net energy consumption as the anaerobic process consumes less energy.

AUTOMATION AND COMPUTERISATION

Critical parameters in the biological treatment process like pH and NH_3 content are controlled by a closed loop control system monitored by a computer. Ammonia stripping at higher pH for stripping of fixed ammonia in ammonia liquor is a very effective technology but with complete automation and computerisation.

Single stage computer controlled bio-treatment units are now being used to treat raw coke oven effluents without any prior treatment to meet the stringent existing pollution control norms.

TREATMENT OF EFFLUENTS OF COKE OVEN PLANTS IN SAIL

Plant	Number of Units	Capacity (M^3/hr)	Specific Features	Remarks
BSL	2+1	250	2 ASPs two-stage and one TF	–
BSP	1	200	Single Stage ASP, TF	–
DSP	2	180	ASP two stage	–
IISCO	2	11 & 18	Single stage ASP	Upgradation of ASPs to second stage
RSP	1	150	Two stage ASP, TF	TF Stage placed between ASP 1st snf 2nd Stage

ASP : Activated Sludge Process
TF : Trickling Filter

SUGGESTED READINGS

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DO YOU KNOW ?

Q7. What percentage of water in the world is fresh water ?

Q8. How often do snakes close their eyes ?

SHORT COMMUNICATION

WAS THE DINOSAUR COLD-BLOODED OR WARM ?

D. Balasubramanian*

Huge animals and birds fascinate us—the elephant, the hippo, the mythical roe bird and the extinct dinosaur. Interest in the dinosaur has been rekindled since the discovery of its remains in many parts of America and Europe during the last sixty years, and more recently with the film *Jurassic Park*. The beast is treated with awe and dread, the very nomenclature of one member of the family betraying this—*Tyrannosaurus rex* (the king of tyrants), which roamed the Western states of America a 100 milion years ago in its full glory of 20 feet in height, 50 feet in length and 6 tonnes in weight. Even the word "dinosaur", coined by Richard Owen of England in the 1806s, means the "terrible lizard". The dinosaur was native to the Indian continent too, as Professor Ashok Sahni of the Geology department of Punjab University at Chandigarh would show you ; his office room is cluttered with dinosauriana—an egg here, a bone there, appropriate enough for a geologist interested in ancient lore dating to the Cretaceous (70 to 135 million years ago) and Jurassic eras (135-180 million years ago). Adding to the awe is the mystery of the sudden and total extinction of the dinosaurs. Did they die of starvation; of a shift in global temperature due to the dawn (or dusk) of another ice age, or did a massive meteor crash on earth and wipe them out (the current consensus)? As they say in All India Radio when reporting about the Parliament : the debate is on.

Was the dinosaur cold-blooded or warm-blooded? The question is important from the point of their ancestry and also with regard to their vulnerability to the vagaries of the elements. Their name denotes their descent from the lizard, or the reptiles. That means they should be cold-blooded, sluggish and generally not very active for their size. Many dinosaurs, such as the protoceratops did lay eggs rather than bear live young ones. It is more convenient to be cold-blooded in one sense—you do not have to fight the weather, just become attuned it. Metabolism slows down and you get to rest. As the temperature outside changes, so does your own, hence the name *poikilotherm* for a cold-blooded animal (*poikilos* meaning various in Greek, and *therm* refers to heat or temperature).

Cold-bloodedness is an ancient adaptive practice; only later life-forms began to keep their body temperature constant (*homeotherm*). This experimentation with homeothermy got off in fits and starts. Primitive mammals like the flat-footed duckbill or the platypus of Australia were the earliest homeotherms, with their body temperatures ranging in the 27-37° zone. Some mammals and birds have still not made up their minds—when it gets very cold outside, they shut off their body thermostats and become poikilotherms. It is only later in evolution, with higher vertebrates such as cats and the birds, that the body temperature attains the 37°C constancy; not quite constant, since a range of 4°C is quite usual, with the extremities like the fingertips or tail usually colder than the core or central area of the body like the backbone or stomach, which are invariably warmer.

Even among the poikilotherms there are animals that regulate their body temperature using the

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environment. These *ectotherms* pick up heat from the sun or the ground to heat themselves a bit. In contrast, *endotherms* need to use their own physiology and metabolism in order to generate heat and maintain body temperature. This imposes a high food demand. It is estimated that a portion of the metabolic rate of an animal is devoted to keeping its body temperature constant. This non-negotiable portion is the basal metabolic rate or BMR. BMR has been seen to be proportional to the 0.7th power of the body weight of the organism and this curious 0.7 is rationalized in terms of the ratio of the body surface area to the body volume. The more surface area and animal or a bird has for its weight, the more its BMR. The canary which weighs 18g has twice the BMR of a 300g pigeon, which has three times the BMR of a human.

To get the BMR going in order to regulate body temperature requires energy or food. While a 60 kg man eats about a $\frac{1}{2}-1$ kg of food every day, imagine what a 5,000 kg dinosaur would eat. The food requirements of colonies of dinosaurs would have been very large indeed and over the years these beasts would have found it a challenging proposition. Yet, we have evidence that they rode the world successfully for about 150 million years before they became extinct in the late Cretaceous period, perhaps 65 million years ago. The question of whether they were cold-blooded or warm-blooded is thus a relevant one. Circumstantial evidence points either way. They origin, their morphological similarity and other factors classified them with the lizards which would make them cold-blooded. Yet, there are conflicting factors. They walked on their hind legs with a fairly upright posture. The microscopic structure of their bones resemble those of mammals. And the ratio of carnivorous to herbivorous dinosaurs suggest a high intake of food as required of warm-blooded animals. How does one then settle an issue of this importance about an animal that is long since dead and gone? All it has left behind are the fossile and the eggs. One needs to reconstruct physiological and biochemical information from these. It is here that geology comes to the aid of biology.

The great American chemist, Harold Urey, specialized in many aspects of isotope chemistry. He was concerned about how isotopes are formed, how for each element there is a set proportion of various isotopes and how these isotopes are handled differently by living organisms and inorganic matter. He was the one who showed that isotopes have different physical properties and that it is indeed possible to distill naturally-occurring water repeatedly and to separate two types of water from it; water with a molecular weight 18 and water of molecular weight 20. The latter, known as heavy water, contains the isotope of hydrogen (deuterium) that weighs twice as much as the hydrogen in the light water, i.e., hydrogen of 1 atomic unit. He also showed that the element of oxygen comes in three types—oxygen weighing 16 atomic units, 17 atomic units and 18 atomic units. Heavy water actually comes in a variety of types; not just of mass 20 but even of mass 22, which contains two deuterium atoms and one atom of oxygen-18.

More relevant to us is the discovery by Urey and later by McRea and Jacob Bigeleison that the isotope composition of oxygen in fossils varies depending on the temperature of the living organism from whom the fossil was made. This is largely because of the finding that the oxygen isotope composition in a tissue like the bone or the shell is a function of the body temperature at which the tissue is formed as well as of the isotope composition of the body water. Thus, if one were to measure this isotopic composition it gives us an indication of the body temperature of the organism—appropriately enough, this connectivity has come to be known as paleothermometry.

What is the idea behind paleothermometry? The animal is dead and gone millions of years ago, and all that is left is some fossilized bone. Yet geologists find that in these bones "the moving finger writes, and having writ moves on". Study the isotope composition of the oxygen in the fossil, compare the value with that of an agreed upon, and you can tell the temperature of the organism when it was alive. (The standard that everybody has agreed on is the oxygen isotope ratio of ocean

water called standard mean ocean water or SMOW).

Work with paleothermometry and fossil carbonates was later extended to fossil phosphates by Drs Crowson, Showers, Wright and Hoering in 1991. They showed that the phosphate ion exchanges the oxygen isotope with water more slowly than carbonate does and is thus a better index if you want to go further into the ancient mists of time.

Drs Reese Barrick and William Showers of the Department of Marine, Earth and Atmospheric Sciences, North Carolina State University, Raleigh in America, decided to exploit the Paleothermometric approach to the question of whether dinosaurs were cold-blooded or not. To this end, they approached the Museum of the Rockies at Bozeman, Montana, USA, and collected 54 samples from 12 bones of various parts of the body of the *Tyrannosaurus rex*. The samples were taken sequentially from the outer part of the body to the inner spongy, porous middle part called the cancellus. The oxygen isotope composition of the bone, delta-P, was measured with each bone and for the various bones. Using the relation between delta-P and the SMOW values, they were able to determine that the temperature difference between interior bones such as ribs, dorsal vertebra and the extremities (tail-region, foot) was about 4.2°C. As expected, the warmest parts were in the interiors while the coldest were the extremities. Within each bone itself, the difference in delta-P ranged between 0.4 to 0.9, suggesting a temperature difference of 4°C, which is an acceptable value for a homeotherm. Based on this, they concluded that the *T.rex* was a warm-blooded animal or, as they put it, a non-migrant endotherm. Information gathered from the leaves in the Montana region where the great beast roamed during that time, suggests that the annual mean temperature in that era was between 11-13°C. For a 5-tonne beast, it appears that the body temperature should have been above 20°C in order for it to digest food.

A paper of this kind takes a leap from one discipline of science to another and connects the two in an interesting and unexpected fashion. But then that is the beauty of science—that it is a unified whole and not walled away into isolated disciplines.

Given the grandness of the scale, the impact and the interest that the paper has generated, it is not surprising that it also became controversial. Dr Andrew Millard of Oxford University in England took issue with the Barrick-Showers conclusions, and wrote about it in the 17th March 1995 issue of Science. He commented that the American scientists might not have been totally correct because they used very small samples of bone phosphate. This does not allow one to sample a reasonable distance across the bone, particularly because the isotope layers itself distinctly cover longer distances. He pointed out the the interior of the bone has microscopic channels through which blood vessels run, carrying blood and physiological water, which somewhat scrambles the isotope ratio. Thus, the average value across the bone and the variations in delta-P might have been underestimated. That means the temperature differential with the bone of 1.7 to 3.8°C, sugested by Barrick and Showers, would also be an underestimate and the range would be more like 10-22°C. Ignoring these microscopic channels, called the Haversian Canals (named after the English anatomist Clapton Haversian who discovered them in the 16th century), would complicate the results; that the higher temperature range across the bone could argue equally well for the dinosaur being cold-blooded!

Not to be left behind, Barrick and Showers responded to this challenge and got together with the geologists Scott Brande and Michael Neilson and biostatistician Malcolm Turner of Alabama and reanalyzed their data and found that Millard's objection was not all that strong. For good measure, they also did isotope composition measurements within the bone of a modern cow and a modern deer, using sample sizes similar to that taken for the dinosaur. The results found here were comparable to those seen with *T. rex*. Conclusion : the mighty beast *T. rex* was a homeotherm.

KNOW THY INSTITUTIONS

NATIONAL ATMOSPHERIC RESEARCH LABORATORY (NARL), TIRUPATI

The gaseous envelope surrounding the earth is known as the terrestrial atmosphere. By virtue of its composition the atmosphere regulates the temperature and provides shielding effect from harmful wave lengths of the solar radition, thus making the life on earth possible. The division of the atmosphere is in the form of spherical shells named as the troposphere, the stratosphere, the mesosphere and the thermosphere and is characterized by the way temperature varies with height. Statistical description of atmospheric motions over the earth, their role in transporting the constituents of the atmosphere and the transformation of different forms of energy constitute the subject of atmospheric dynamics and is studied with sophisticated instrumentation systems. Hence it is important to investigate prevailing winds, waves, turbulence, atmospheric stability and various mesoscale phenomena.

Over a time activities of NMRF have increased in scientific utilization and involved in major research programmes related to atmospheric science. NMRF also installed a number of complementary and supplementary experimental facilities for atmospheric studies in the last 10 years. Understanding the need of the atmospheric science research in the country, NMRF is taking a major initiative in diverse areas of atmospheric research and developing and installing a number of state-of-the-art atmospheric instruments.

Considering these facts and to give wider scope, name of the center is changed as National Atmospheric Research Laboratory (NARL).

NARL is administered by a Governing Council consists of eminent scientists from various More importantly, reliable information for low latitudes is essential to improve our understanding of the climate and weather variation. This is more so for a country like India, whose economy is predominantly agriculture based. Indian scientists have carried out pioneering research work in the fields of astronomy and astrophysics, solar/ interplanetary medium, earth's upper atmosphere/ ionosphere, aeronomy/middle atmosphere and weather/climate phenomena. Realizing the importance of the middle atmospheric dynamics and other physical processes, the Indian scientists initiated major scientific studies under the Middle Atmospheric Programme (MAP). Under this programme, a state-of-the-art Mesosphere-Stratosphere-Troposhere (MST) radar was established at Gadanki near Tirupati as a national facility. This facility was registered as National MST Radar Facility (NMRF), an autonomous Scientific Society under Department of Space, Government of India in 1993.

The Governing Council sets broad policy guidelines for NARL. A Scientific Advisory Committee (SAC) consisting of eminent scientists in the field of atmospheric science, monitors the activities and progress of NARL and provides future directions of research activities. Now NARL has become a prime centre for atmospheric research in the country and operates a state-of-the-art MST radar, Rayleigh/Mie Lidar, Boundary Layer Lidar, Sodium Lidar, Lower Atmospheric Wind Profiler (LAWP), Disdrometer, Optical Rain Gauge (ORG), Dual frequency GPS receiver, Automatic Weather Station (AWS), and balloon-borne experiments in campaign mode. Salient features and the capabilities of the experimental facilities are given in detail.

ONGOING PROJECTS

(I) Coherent Radar Imaging/spatial Domain Interferometry (CRI/SDI)

National Atmospheric Research Laboratory has taken up CRI/SDI project, which will enhance the capabilities of the present MST radar by many folds. The existing MST radar, with a 32×32 antenna phased array and a single back-end receiver, was originally configured for Doppler Beam Swinging (DBS) mode. A brief description of the ongoing project is given below :

Transmitting system

The existing antenna array will be modified to obtain a broad beam with 10° width for the purpose transmission. The central 16×32 part of the array will be phase coded in a similar fashion to that introduced for Jicamarca radar, Peru.

A peak power of 900 KW will be available when the array is phase coded. Provision will be made to retain the basic narrow beam, with 3° width and a peak power of 2500 KW for normal DBS mode of operation.

Receiving system

The receive antenna consists of 21 modules, each one being a small hexagonal array of 19 Yagi elements. Each antenna module will have a beam width of about 180 and connected to a dedicated receiver and data acquisition system. The receive array configuration is conceived keeping in mind the requirements for probing various regions of atmosphere, that is, ionosphere, Mesosphere, Stratosphere, Troposhere and boundary layer regions. This configuration supports to carry out experiments in SA, SDI, IDI, TDI, PBS and Imaging modes. The smallest and thelongest base line lengths available are 8m and 270m respectively. The RF front-end units will be placed in an enclosure located in the antenna field.

The direct digital receivers with dedicated primary data recorders will be located in the instrumentation room. The receivers and the archival system are controlled by a master controller (server) through an optical network.

Wide beam system

A separate system is being developed for imaging the meteor trials, lightning, precipitation and convective events whose horizontal spatial extent is very large. Crossed Yagi antennas with 900 beam width will be used to cover the large horizontal extent of the atmosphere. A single crossed Yagi, connected to a 120 KW transmitter unit, is used for the transmission purpose and 17 dipoles will be configured in a '+' shaped array for reception. The dipoles are connected to the receivers, described above, through a switching network.

(II) Estimation of electron density profile using Faraday rotation using of coherent scattered signal

Electron density measurements of the earth's ionosphere are extremely important for understanding the electrodynamics, plasma instabilities and more importantly for the contemporary interest to study the space weather. Local time and seasonal variability of the electron density is extremely important for academics well as practical purpose with applications to satellite communication & navigation, development of equatorial ionosphere model & its applications to remote sensing.

The conventional tools to measure electron density profile are rocket probes and incoherent scatter radar. The project being developed at NARL is based on the property of the propagation of the electromagnetic wave in an ionized medium. The Faraday rotation of the planepolarized wave traveling through the ionized medium is proportional to electron density. In this project, it is proposed to estimate the electron density profile using the coherent forward scattered signals from the ionosphere.

(III) Rayleigh Doppler Lidar

Interpretation of most of the middle and upper atmospheric dynamical and chemical data relies on the climatological description of the wind field. Rayleigh Doppler lidar is one instrument which monitors wind profiles continuously (though continuity is limited to clear meteorological conditions) in the middle atmosphere. A Doppler Rayleigh lidar, operating in incoherent mode, gives excellent wind and temperature information at altitudes with necessary spectral sensitivity.

It observes atmospheric winds by measuring the spectral shift of the scattered light, due to the motions of attmospheric molecules. The Doppler capability as an augmentation to the existing lidar is being designed to cover the height range of 30-65 km, a region where radars cannot provide winds. With the addition of Doppler Rayleigh capability, NARL becomes a unique facility of providing a continuous profile of wind measurements, without any gaps, from near the ground to 110 km though with different techniques.

Off-line Data Processing System

NARL has established a full-fledged off-line data processing system with necessary software for user scientists of MST Radar and other systems. To support the user scientists on analysing their experimental data, centre has developed a versatile data processing package under MS Windows with networking environment. The data processing software package called **"ATMOSPHERIC DATA PROCESSOR" (ADP)** is a multi-purpose package with analysing, processing, disseminating and post processing utility under graphical environment. This is a user friendly menu-driven software package. The package supports complete

signal processing to extract the atmospheric parameters such as three first order moments (Signal Power, Mean Doppler, Doppler Width) and the wind velocity in three directions (uvw). Extensive data searching and graphical support is provided to visualize and interpret the scientific observations.

For more information please contact :

Director, National Atmospheric Research Laboratory, Post Box : 123, Tirupati-517 502, India. Telephone + 91 85 85 272001 / 272002 Fax + 91 8585 272018/27202 Email narl@narl.gov.in

ANSWERS TO "DO YOU KNOW ?"

A1. Sparrow.

A2. A swan has 25,000 and a duck has 12,000 feathers.

A3. About 50%.

A4. Sodium and Chlorine.

A5. The sex of the offspring depends on it, above 87°C it is male and below female.

A6. 75-80% of taste is smell. The tongue can perceive only four tastes-sweet, salty, bitter and sour. The rest more complicated taste are actually smells. With nose closed, potato and apple taste the same.

A7. 3% approximately.

A8. Never.

Conferences / Meetings / Symposia / Seminars

Date	Topic	Contact
15-18 October 2007	**ASME India Oil and Gas Pipeline Conference,** New Delhi	**Gauri Nath** Program Manager, Strategic Initiatives ASME International 3 Park Avenue, New York, NY 10016 Email : nathg@asme.org
23-25 November 2007	7th Annual Conference of the **Society of Pharmacovigilance, India.** Jaipur	**Dr. Anurag Tomar** NIMS City Centre, 4 Govind Marg, Near Moti Dongri, Jaipur (Rajasthan) Email : sopijaipur@yahoo.com
14-16 December 2007	International Conference on **Web Engineering & Applications,** Bhubaneswar	**Dr. Jibitesh Mishra** IT College of Engineering & Technology Ghatikia, Bhubaneswar-751003 Email ID : mishrajibitesh@yahoo.com
17-20 December 2007	International Conference on **Microwaves & Optoelectronics,** Aurangabad	**Dr. S. C. Mehrotra** Dept. of Computer Science & Information Technology Dr. Babasaheb Ambedkar Marathwada University Aurangabad Email : chairman@icmo2007.org
28-30 December 2007	International Conference on **Information and Communication Technology**, Manipal	**Dr. Manohara Pai M M** Dept. of Information and Communication Technology, Manipal Institute of Technology, Manipal 576 104 Email : icicot07@manipal.edu

Date	Topic	Contact
3-7 January 2008	**95th Indian Science Congress,** Visakhapatnam	**General Secretary** The Indian Science Congress Association 14 Biresh Guha Street, Kolkata-700 017 Email : iscacal@vsnl.net.
5-8 January 2008	World Congress on **Psychology and Spirituality India,** Delhi	**Shruti,** 102/45 Silver Oaks DLF City 1, Gurgaon 122002 Haryana Email : shruti@auromail.net
3-6 February, 2008	1st International Conference on **Drug Design and Discovery,** Dubai	**Organizing Secretariat, ICDDD 2008** Executive Suite Y-26, *PO BOX 7917* Saif Zone, Sharjah, U.A.E. Email : info@icddd.com

Kindly send detailed news of upcoming Seminar / Symposia / Conference (atleast 6 months before the date of commencement) to be published in **Everyman's Science**.

S & T ACROSS THE WORLD

AGRICULTURE BASED ON ZODIAC

A series of lectures delivered by an Austrian philosopher, Rudolf Stainer, eighty-three years ago, has led to the adoption of several innovative agricultural practices in Karnataka, Andhra Pradesh and Tamil Nadu these days.

These operations are based on the zodiac principles of the crop calendar, which is similar to the almanac for humans, and is referred to as biodynamic farming. The basic theory is that the 12 zodiac signs, connected to the movement of the moon, are divisible into four groups, corresponding to the four basic elements of earth, fire water, and air, and each group has a certain influence on plant life. Thus, Taurus, Virgo, and Capricorn are connected with the soil, and help in the development of the root systems, while Gemini, Libra and Aquarius are connected with air and sunlight and help in flowering. Similarly, Cancer. Scorpio and Pisces said to relate to water and influence leaf development, while Aries. Leo and Sagittarius are concerned with fire and help in the development of fruit and seed.

According to this theory, field preparation, manture application and transplanting of seedings should be done during the waxing phase of the moon, while sowing, foliar operations, and harvesting should be done during the moon's waning phase.

The results of biodynamic farming are reported to be encouraging enough to get the Indian Council of Agricultural Research (ICAR) and the National Horticultural Board (NHB) interested in these techniques, and the harvest is supposed to have better taste and aroma compared to conventional methods.

(Business Line, Nov 21, 2006)

TWIN CHAMBERED IMPREGNATION PLANT

Proomivac Engineers, a Delhi-based firm, has developed a double chambered continuous impregnation plant which is designed to ensure high quality of impregnation at a much faster rate than the conventional type.

Both the chambers in turn can be used for impregnation as well as for storage, thereby not only increasing storage capacity but in saving time.

The tanks are fabricated from MS plate of appropriate thickness, and are fitted with leak proof lids with handles. Two viewing ports are provided on each tank for observing the process under light. Each tank is provided with a vacuum gauge, vacuum line valve, and air leak valve. At the bottom is the impregnate admittance valve, the drain valve, and the inter-transfer valve. The unit is mounted on angle iron stand for facilitating smooth and easy operations. A double stage high vacuum pump driven by an electric motor is supplied with each unit.

A specially fabricated liquid trapping-cum-filter assembly is incorporated between the vacuum pump and chambers to check the back flow of oil and impregnant in case of sudden stoppage of pump due of failure of electricity or otherwise.

(Evn. Pollution Control Journal, Jan-Feb 2007)

STEM CELLS TO TREAT BRAIN DISEASE

Stem cells taken from the embryos and fetuses of humans left over in fertility clinics and transplanted into mice brain with the equivalent of Sandhoff disease, have been found to move through the brains of the diseased mice, to take on jobs of damaged neurons, thereby delaying fatal brain and nerve disorders.

These findings have been reported in a study published in the journal *Nature Medicine* and may

hold the key to treating several neurodegenerative diseases, such as Parkinson's, Alzheimer's and amyotrophic lateral sclerosis, also known as ALS or Lou Gehrig's disease.

Sandhoff disease is marked by severe inflammation of the brain cells causing mental retardation and motor dysfunction and in the case of the young, death typically occurs in infancy. It is very difficult to treat this condition, because of the blood-brain barrier which acts as a molecular gateway that keeps many drugs out of the brain, and children with Sandhoff rarely live beyond the age of 6.

It was noted that the cells which were transplanted into the brains of mice, created no side effects, and the treated mice lived 70 percent longer than the untreated mice. Eventually the disease came back, but the researches feel that it might be possible to keep the disease at bay by giving booster injections of stem cells to take over the functions of the multed natural brain cells.

(Scientific American, Mar 12, 2007)

GETTING TAN WITHOUT SUNLIGHT

Researchers at Harvard's Dana Farber Cancer Institute have discovered that a protein known as p53, which has long been considered the master regulator of the genome because of its ability to repair damaged DNA, triggers off a chemical cascade leading to the production of melanin or pigment without needing the sun.

When the protein is disabled, it cannot fulfil its role in tumour suppression, by providing melanin cover, as a result of which the tumour cells proliferate unchecked leading to melanoma or skin cancer.

(Scientific American, Mar 12, 2007)

RESTENOSIS

Restenosis is the process where even after angioplasty and the insertion of a stent to keep the artery open, in 25-30 percent of the cases, the artery becomes blocked again.

Researchers, in the USA, after studying two breeds of pigeons, one that is genetically susceptible to heart attacks and the other that is resistant, believe that genetic factors which stimulate the uncontrolled growth of smooth muscle cells from the heart vessels may be to blame for the blockage.

(News-Medical. Net, Feb 22, 2007)

भारतीय विज्ञान कांग्रेस संस्था

14, डा० विरेश गुह स्ट्रीट, कोलकाता 700 017, भारत

THE INDIAN SCIENCE CONGRESS ASSOCIATION

14, Dr. Biresh Guha Street, Kolkata-700 017, INDIA

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Telephone	:	(033) 2287-4530, 2281-5323	E-mail	:	iscacal@vsnl.net
Website	:	http://sciencecongress.nic.in			iscacal_2004@yahoo.com

Terms of Membership and Privileges of Members :

Membership of the Association is open to persons with *Graduate or equivalent academic qualification* and interested in the advancement of science in India.

1. **Member :** A person willing to be enrolled as new Member has to pay an annual subscription of Rs. 200/- **along with an admission fee of Rs. 50/-** (for foreign* U.S. $70) only. The annual subscription of a Member shall become due on the 1st April of each year. Anyone who fails to pay the subscription on or before the *15th July* in any year shall lose the right of voting and / or holding any office of the Association for that year. A Member failing to pay the annual subscription by the end of March of the following year shall cease to be a Member.

   Members may contribute papers for presentation at the Science Congress. They will receive, free of cost, reprint of the Proceedings to Session of any one section of their interest and also the bi-monthly journal of the Association "Everyman's Science".

2. **Sessional Member :** Sessional members are those who join the Association for the Session only. A Sessional Member has to pay a subscription of Rs. 250/- (for foreign U.S. $60) only.

3. **Student Member :** A person studying at the under-graduate level may be enrolled as a Student Member provided his/her application be duly certified by the Principal/Head of the Department. A Student Member shall have the right to submit papers for presentation at the Session of the Congress of which he/she is a member, provided such papers be communicated through a Member, or an Honorary Member of the Association. He/she shall not have the right to vote or to hold any office. A Student Member shall not be eligible to participate in the Business meetings of the Sections and the General Body.

4. **Life Member :** A Member may compound all future annual subscriptions by paying a single sum of Rs. 2000/- (for foreign U.S. $ 500) only. Any person who has been continuously a member for 10 years or more, shall be allowed a reduction in the compounding fee of Rs. 50/- for every year of such membership, provided that the compounding fee shall not be less than Rs. 1,200/- (for foreign U.S. $ 12.50 and U.S $ 300 respectively). A Life Member shall have all the privileges of a member during his/her lifetime.

**Admission fee of Rs. 50/- is needed only for becoming a new annual member and not for sessional member / life member / Institutional member / student member / donor.*

5. **Institutional Member :** An Institution paying a subscription of Rs. 5,000/- (for foreign U.S. $ 2,500) only, can become an Institutional Member of the Association. It shall be eligible to nominate one person as its representative to attend Annual Session of the Science Congress. An Institutional Member shall be eligible to receive, free of cost, a copy of the complete set of Proceedings of the Annual Science Congress Session as also a copy of the Association's journal "Everyman's Science".

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A) **Presentation of Papers :** A copy of complete paper accompanied by an abstract in triplicate not exceeding one hundred words and not containing any diagram or formula, must reach the Sectional President General Secretary (Hqrs) Latest by *September 15*, each year.

B) Members of all categories are entitled to railway Concession of return ticket by the same route with such conditions as may be laid down by the Railway Board for travel to attend the Science Congress Session provided that their travelling expenses are not borne, even partly, by the Government (Central or State), Statutory Authority or an University or a City Corporation.

C) Members of all categories are entitled to reading facilities between 10.00 a.m. to 5.30 p.m. on all weekdays (except Saturdays & Sundays) in the library of the Association.

D) Members of all categories may use Guest House facilities, Lecture Hall hiring at the rates fixed by the Association from time to time.

Note : All Money Orders, Bank Drafts etc. should be drawn in favour of "*Treasurer, The Indian Science Congress Association*". Members are requested to mention their Card No. while making any correspondence to ISCA office.

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* (A Foreign Member means one who is normally resident outside India.)

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APPLICATION FORM FOR MEMBERSHIP

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The General Secretary
The Indian Science Congress Association
14, Dr. Biresh Guha Street,
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Stamp Size Photograph

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I like to be enrolled as a Member / Life Member / Donor / Sessional Member / Student Member / of The Indian Science Congress Association.

I am sending herewith an amount of Rs. ..... in payment of my subscription by Bank Draft / Money Order / Cash for Membership / Life Membership Subscription / from the year 1st April 200 ..... to 31st March 200 .....

I am interested in the following section (Please tick any one).

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4. Chemical Sciences
5. Earth System Sciences
6. Engineering Sciences
7. Environmental Sciences
8. Information and Communication Science & Technology (including Computer Sciences)
9. Materials Science.
10. Mathematical Sciences (including Statistics)
11. Medical Sciences (including Physiology)
12. New Biology (including Bio-Chemistry, Biophysics & Molecular Biology and Biotechnology)
13. Physical Sciences
14. Plant Sciences

(Please type or fillup in Block Letters)

Name (in block letters) : _____ SURNAME _____ FIRST NAME _____ MIDDLE NAME

Academic Qualifications :
(Evidence to be submitted)

Designation :

Address for Communication :
(including State, City/Town and Pin code)

Phone No. & e-mail

Permanent Address :

Yours faithfully

Date : Signature

- *As per resolution of Executive Committee in its meeting held on October 10, 2004 application for membership of ISCA in 'Care of' of some other person is generally discouraged. However, if in the application form "care of" address is given then there should be also signature of the person in whose name "care of" is given.*
- *Admission fee of Rs. 50/- is needed only for becoming a new annual member and not for sessional member / life member / Institutional member / student member / donor.*

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Registered with the Registrar of Newspapers for India under No. R.N.I. 12058/66

FORM IV

Rule 8

1.	Place of Publication	Indian Science Congress Association 14, Dr. Biresh Guha Street, Kolkata 700 017
2.	Periodicity of Publication	Bi-monthly (Published every two months)
3.	Printer's Name Nationality Address	Shri Partha Pratim Hazra Indian M/S Seva Mudran, 43, Kailash Bose Street, Kolkata 700 006
4.	Publisher's Name Nationality Address	Prof. S.P. Mukherjee, Indian Indian Science Congress Association 14, Dr. Biresh Guha Street, Kolkata 700 017
5.	Editor in Chief's Name Nationality Address	Prof. S.P. Mukherjee Indian 1/4 Buxarah Village Road, Howrah–711109
6.	Name and Address of individuals who own the newspaper and partners of Shareholders holding more than one percent of the total capital	The Indian Science Congress Association 14, Dr. Biresh Guha Street, Kolkata-700 017

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Date : 06. 07. 07

S.P. Mukherjee
Publisher
Everyman's Science