English: the heartbeat of world science

The results of the ACER–PISA test for annual global assessment of students' skills for 2011, conducted by the Organization for Economic Cooperation and Development, shows the Chinese on the top and the Indians in the last but one position of the South and South East Asian nations[1]. The analysis puts the blame squarely on 'ineffective' English teaching in professional institutions and consequent 'inability' of the students to frame a sentence on their own in English. A cartoon in an English daily, illustrating the article shows the Indian students sleeping or chatting over a laptop, whereas the Chinese students take pains to learn and practice.

Whether or not English is the international language of science is no more debated. The issue is the assessment of the contribution to science by different linguistic nations vis-a-vis their standards in English, for the discussion of which *Current Science* has contributed much in the past[2]. With around 400 million people learning English as first language across the world, 350 million people as second language as in India and over a billion people learning English as a foreign language like in China, Russia, Korea or Japan, it is no surprise that more than 60% of research publications are in English, with the rest in vernacular languages[3] giving titles, abstracts or parallel translations in English. 'Non English' speaking countries are putting a great effort to improvize their English speaking abilities, as English is seen as the 'language of science'.

India, with a different historical background, is almost an English-speaking country with limping standards[4]. In spite of the ever-expanding higher education of the country (around 200,000 institutions by the end of the XI Plan period, 2007–2012, including colleges, universities, IITs, IIMs and polytechnics), a steady decline in English standards is being observed.

Thanks to the e-mails, chatting, SMS and other computer and cellphone operations all over the world, scientific English is receiving a further jolt.

The inability to comprehend good scientific English and publish good work is not confined to the non-English speaking countries alone, with researchers from the UK, USA, Canada or Australia are no better[5]. The difference between the two groups is a matter of quantity of grammar and syntactic errors in English writing than in the quality of expression and thematic logistics[6].

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Pharmacognostic standardization to diminish involuntary adulteration and substitution in Ayurvedic herbs

The ancient indigenous system of medicine – Ayurveda is in great demand and popular in developed and developing countries as it gives effective remedies for the functional disorders, chronic diseases and age-related problems. However, a serious drawback of the Ayurvedic system is identifying the genuine medicinal herbs prescribed by the founders of the system. The description of medicinal plants is more poetic than scientific and lacks precision, due to paucity of technical language. Moreover, the founders did not follow a systematic and technical format for description of plants. So the interpretation of the description in Sanskrit is largely influenced by views of the interpreters. This often leads to adulteration and/or substitution in official resources of Ayurvedic herbs. Unscientific nomenclature is another serious drawback of Ayurveda. According to the principle of nomenclature, one plant species has only one valid binomial name, which diminished the possibility of confusion. Absence of such well-defined and uniform system of nomenclature accompanied by indiscriminate use of local names has created great confusion in this subject, e.g. 'Pittapapda' is a complex in which nine different species such as *Glossocardia boswallea* DC., *Fumaria indica* (Haussk.) Pugsley, *Naregamia alata* Wight & Arn., *Rostellularia procumbens* (L.) Nees, *Rungia repens* Nees, *Mollugo pentaphylla* L., *Polycarpaea corymbosa* Lam., *Hedyotis corymbosa* (L.) Lam, and *Peristrophe bicalyculata* Nees are traded in different geographical regions of India under the same trade name[1]. Majority of plant materials are collected by local people with lack of correct identity of the resources, resulting in a collection of superficially similar natural resources, e.g. stem bark of *Saraca asoca* De Wilde is the authentic drug of 'Ashoka'. Stem bark of *Saraca declinata* L., *Trema orientalis* (L.) Blum and *Polyalthia longifolia* Benth are morphologically similar and commonly intermixed with the genuine sample. Frequently, the adulterated product may have no relation with the genuine plant material, and may or may not have any of the therapeutic chemical compounds desired, e.g. authentic source of 'Nagakeshar' is the anther of *Mesua ferrea* L. However, flowers of *Mammea longifolia* Planch. & Triana and *Calophyllum inophyllum* L. are adulterated with the genuine sample[2]. Fulfillment of increased demands is becoming difficult day-by-day with declined availability of resources due to over-exploitation, which leads to use easily available plant parts from the same or different plants, e.g. root of *Sida cordifolia* is recommended in 'Deshmula', but the whole plant or aerial parts of the same or different species of genus *Sida* are found to be traded. In view of the above facts, use of such plants as a common drug can be accredited only after standardization, analytical and biological studies to assure quality, safety and efficacy of the final herbal products.

The World Health Organization has developed guidelines for carrying out standardization procedures of raw herbal products which include pharmacognostic tools such as morphological, histological, physico-chemical, analytical and toxicological parameters, heavy-metal estimation and radiobiological contamination in plants[3]. Other factors such as the use of fresh plants, temperature, light exposure, period and time of collection, method of collection, drying, packaging, storage and transportation of the raw material, and age and part of the plant collected can greatly affect the quality and consequently the therapeutic value of herbal medicines. In such cases, where the active principles are unknown, markers should be established for analytical purposes. However, in most of the cases these markers have never been tested to see whether they really account for the therapeutic action reported for the herbal drugs[4,5]. Strict standardization procedures and pharmacognostic studies of medicinal plants would drastically reduce ill-effects due to wrong prescriptions of traditional herbal medicines. This will be helpful in identification procedures that guarantee the utilization of the appropriate raw material and for quality-control standards demanded by legislation.

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Potential of renewable energy in meeting future needs of electricity

In an article analysing the future Indian needs of electricity and the possibility of meeting them by renewable energy, Sukhatme[1] concludes that renewable energy sources alone will not suffice for meeting requirements and that nuclear energy will have to assume a significant role. Electricity requirements and its growth have been estimated by Sukhatme using the methodology adopted earlier by Goldemberg *et al.*[2]. A conservative estimate of 2000 kWh of electricity per capita has been arrived at in an austere model. This is validated using correlation analysis between electricity consumption and human development index. Thus he estimates that India should have electricity generation of at least 3400 TWh per annum for a stabilized population of 1.7 billion by 2070.

However, a significant underestimate occurs in Sukhatme's estimation of the potential of Indian renewable energy sources, in particular solar energy. Assuming that limit to exploitation of solar energy in India will arise from availability of open non-agricultural land, he estimates approximately 10,000 sq. km (1 million hectare) will be available for solar energy utilization. However his 'thumb rule' estimate of 4 ha/MW as land required per site seems to be an overestimate, as may be seen from the following data (Table 1) pertaining to photovoltaic (PV) power plants of varying capacities established mostly during the last two years (2009–2011).

It is evident that an average figure of 1.25 ha/MW is reasonable for a solar PV farm. It may also be noted that the Indian plan under the Jawaharlal Nehru Solar Energy Mission assigns significant role for rooftop PV panels, thus reducing the need for additional open land further.

As far as solar thermal plants are concerned, they require even less land per megawatt, by definition, as they concentrate incident solar energy before conversion. As an example, the solar thermal plant being established at Mathania, Rajasthan will generate 140 MWp in a solar field area of 22 ha, giving a ratio of 0.16 ha/MW for the solar field alone.

Even assuming 1 million hectare land availability as a limitation, India has a solar potential (PV + thermal) of well over 800 GWp, which can generate electrical energy of 1400 TWh/year at a realistic plant load factor of 0.2. As the solar energy conversion efficiencies and plant load factors used in the above calculations are all based on currently established values worldwide, there should be no technical uncertainties in achieving this level of performance.

Summarizing, Sukhatme's estimates of the potential of renewable energy in the Indian energy basket requires significant upward revision. A total installed capacity of 1100 GW (hydro + solar + wind + biomass) producing electrical energy of 2500 TWh/year from renewable energy sources alone – out of the goal of 3400 TWh – by 2040 (Indian population at 90% of stabilized level) from renewable energy sources alone appears to be feasible, realistic – even conservative. This large potential of renewable energy should be compared with the projected plans for a nuclear power component