

Woods to wheels

Limited resources of fossil fuels and increase in greenhouse gas emissions prompt us for an urgent need of renewable and cleaner fuels. Among various options available, bioethanol (cellulosic ethanol) which is renewable and significantly lowers the greenhouse gas emissions is one of the major options. Apart from using sugar and starches as substrates for bioethanol production, lignocellulosic plant waste should be extensively used for bioethanol production. There are pharmaceutical industries in India which have been using various parts of medicinal plants for extraction of useful metabolites for preparation of herbal drugs. The disposal of enormous lignocellulosic plant waste generated by herbal drug manufacturing industries is expected to increase in the near future due to 'Horticulture Mission' of Government of India in which many states are going to increase cultivation of medicinal and aromatic plants. We speculate that in the next 2–3 years, there will be many fold increase in the plant waste in different herbal drug-based industrial areas of Indian states. Although the waste is biodegradable, handling large quantities of waste by using environment-friendly methods has been relatively cumbersome.

And the heterogeneous and recalcitrant nature of waste from herbal drug industries further poses an obstacle for conversion of waste to bioethanol. To tackle this problem, different methods of pretreatment using sulphuric acid, SO₂, NH₃, lime, etc. provide the key to unlock these biological feedstocks for conversion of the same to bioethanol. However, pretreatment is the most expensive single unit operation¹. Using microbes or their isolated enzymes (if the same is cost-effective) to breakdown the lignocellulose waste to fermentable sugars as a consolidated bioprocessing (CBP) seems to be far more promising than the known routes of pretreatment like acid hydrolysis. CBP is gaining increasing recognition as a potential breakthrough for low-cost biomass processing. Although no natural microorganism exhibits all the features desired for CBP, a number of microorganisms, both bacteria and fungi, possess some of the desirable properties². Subsequently reducing the use of chemicals, nutrients and other additives would have appreciable effects on operating costs. Bioethanol can be easily integrated into the existing road transport fuel system. In quantities up to 5%, bioethanol can be blended with conventional fuel without

the need of engine modifications. Petrol blending with bioethanol will help in the extension of the life of the world's diminishing oil supplies and lead to greater fuel security avoiding burden on oil-producing nations.

The most vital need to realize the great benefits of woods to wheels concept is to commercialize the technology at large scale in India and to put extensive research efforts to overcome the recalcitrance of biomass through natural selection of microorganisms and development of recombinant microorganisms or microbial consortia.

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2. Zyl, W. H., Lynd, L. R., Haan, R. D. and McBride, J. E., In *Advances in Biochemical Engineering/Biotechnology*, Springer, Berlin, 2007, pp. 205–235.

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Academic promotions: The dust has not yet settled

Many renowned universities in India consider scientific publications as one of the criteria for academic promotions¹. In addition to the qualification criterion of a postgraduate degree in the respective subject, the length of service and the number of research projects/scientific publications are considered additional important criteria for academic promotions. However, unfortunately the guidelines for academic promotions are not being strictly implemented by many universities. It does not come as a surprise to us that many professors in medical colleges do not even possess a single publication in *PubMed*-indexed journals to their credit. In this regard, Singh² aptly raises the issue of career advancement promotions based on publications in journals without any peer-reviewing. At the risk of sounding pessimistic, it must be admitted that there does not seem to be any light at the end of this tunnel. Sadly, the dust is yet to settle.

We would like to propose that the medical institutions and universities should insist on a combination of credentials in biomedical research, clinical practice and, most importantly, teaching proficiency while considering academic promotions. Universities should strictly employ the guidelines without bias. While the fundamental requirement for a professor even today remains efficiency in teaching, he should also be a good researcher and a competent practitioner.

1. Kanchan, T., *Med. Hypotheses*, 2008, 70, 462.
2. Singh, H. P., *Curr. Sci.*, 2007, 93, 887.

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