Antibiotic liquid waste disposal – A potential threat and environmental compatibility

Antibiotics like cephalosporins are widely manufactured and used for the therapy of acute pneumonia and infections of the respiratory tract, skin and soft tissues, bones and joints, urinary tract and blood stream. Pharmaceutical industries manufacturing cephalosporin-based drugs, lack adequate treatment and disposal mechanisms due to high concentration of cephalosporin and complex biomass resulting from its reaction with organic solvents and volatile solids available in the combined effluent of the plant. The presence of cephalosporin increases total strength (chemical oxygen demand) of the effluent and it has been reported that 80% of water streams are polluted by pharmaceutical waste[1]. Microbial biotransformation of antibiotics has been reported[2–4] for the preparation of analogues of members of several classes of antibiotics. The formulation and implementation of regulatory standards for the ultimate disposal and reuse of transformed products of antibiotic drugs and solvents have been a pending issue in the waste management of pharmaceutical industries, especially in developing countries. The effect of bioaugmentation on the convertibility of anaerobically transformed intermediates of antibiotic pharmaceutical waste sludge into residuals and biocompost has already been reported[2]. The present regulatory standard implemented in India does not envisage such disposal alternatives and hence this would invite suggestions and recommendations of the experts for possible implementation on the pending issue in the antibiotic-based pharmaceutical industries[5]. To help provide a streamlined system for disposing antibiotic pharmaceutical waste that is protective of public health and the environment, the US Environmental Protection Agency proposed to add hazardous pharmaceutical waste to the Universal Waste Rule[6]. Hence the biotransformation of cephalosporin either alone or in combination with other energetic compounds, offers the potential for an economical and environmental-friendly disposal alternative for the anaerobically transformed intermediates of antibiotic pharmaceutical waste sludge. The method of converting antibiotic waste to biocompost would offer potential and sustainable environmental compatibility.

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Cellulosic ethanol

It is understandable that a call for a mission-oriented project, similar to the Manhattan project, the processing of lignocellulose (plant biomass) – nature's only renewable material – into fuel ethanol has been made[1,2].

A country like India generates nearly 500 mt of agro-waste per year. At Bio-2006, Bill Clinton[3] strongly advocated for cellulose to ethanol rather than corn to ethanol or sugarcane to ethanol 'because: (a) the conversion ratio is better, (b) there is plenty of agricultural wastes all over, and (c) we can create more jobs'.

The 'superbug' of Iogen which Maheshwari has mentioned is actually the use of recombinant DNA-produced enzymes to break apart cellulose to produce sugars from wheat straw. The sugars produced from such a bio-refinery process are used to make greener versions of ethanol and plastics. Such a breakthrough will mean that a farmer could harvest two crops from every field – a grain crop and a biomass crop – both more valuable.

But while on this subject, we should not forget the need and potential of agro-waste for improving soil fertilizer. The post-harvest residue of cotton, castor, trash from sugarcane, etc. can be chopped and sprayed with microbial mixture. The consortia of microbes decompose it and convert it to useful soil nutrient and also supply the much needed organic carbon for which our soils are hungry[4]. Instead, the present practice of burning the crop residue causes terrible damage.

Our efforts to understand the breaking of cellulose waste will be the most important for our soils as well as for biofuels as the next step. Several groups/institutions need to come together for this 'Manhattan'-like project for India.

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