

WATER POLLUTION BY SUGAR MILLS AND DISTILLERY SPENT WASH

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India being a developing country establishing a large number of industries such as sugar distillery, steel, paper, textile etc. that play important role in progress of the nation. These industries along with their product produce wastewater, which causes various environmental problems. However, wastewater characteristics are different from industry to industry. A no. of industries are established in India and distilleries are one of them. These industries produce waste water called spent wash which is in general practice discharge into local water bodies without any treatment. This practice causes water and soil pollution. The spent wash is acidic and loaded with organic and inorganic salts. Being plant origin, the spent wash contains considerable amount of plant nutrients and organic matter. Spent wash is an acidic effluent rich in organic carbon, K, Ca, Mg and S, considerable amount of N, P, traces of micronutrients viz Fe, Mn, Zn and Cu and traces of sugar are also observed. Presence of appreciable amount of plant growth promoters viz gibberellic acid (GA) and indole acetic acid (IAA) have also been detected which further enhance the nutrient value of spent wash. Though the spent wash generally does not contain any toxic metals, but is characterized by high biological oxygen demand and chemical oxygen demand levels which are the main cause of water pollution. The solution of the problem is discharge of waste water into water bodies after proper biological and chemical treatment by the industries. The present paper investigates about all aspects of water and soil pollution caused by distillery spent wash.

KEYWORDS : Distillery spent wash, water pollution.

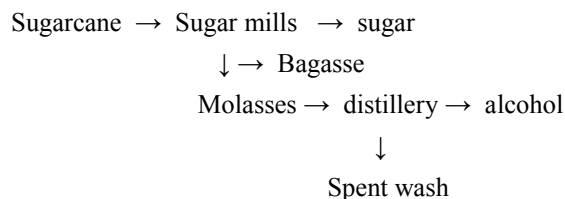
INTRODUCTION

Pollution occurs through different medium, however water and air are two major resources, which get polluted in one way or other. Most of water from natural sources get polluted due to wastewater emerging from chemical industries. India being a developing country establishing a large number of industries such as sugar, distillery, steel, paper, textile etc. that play important role in progress of the nation. These industries along with their product produce wastewater, which causes various environmental problems. However, wastewater characteristics are different from industry to industry. One such major chemical industry is distillery. India is a major producer of sugar in the world and these industries offer

employment potential and contributes substantially to economic development. There are about 579 sugar mills and 285 distilleries in India. Apart from sugar and alcohol these industries generate many by product and waste material (Sindhu *et al.*, 2007). Molasses, one of the important by product, is the chief source for the production of alcohol in distillery by fermentation method.

This molasses contains 7-8 % glucose, which is converted into alcohol by fermentation process. First molasses is diluted by adding water to adjust the total dissolved solids up to 7-8%. Then yeast is added in diluted molasses solution and fermentation process takes place. As process go up glucose is converted into ethyl alcohol and carbon dioxide. This carbon dioxide is removed as a gaseous form, which is collected separately. After sufficient conversion of glucose into ethyl alcohol this solution is now called as a beer solution. This beer solution then passed through distillation column. Based on temperature difference ethyl alcohol is separated from the beer solution and condensed into liquid form. The wastewater from distillery column is called spent wash liquor (Lekshmi, 2013). About 40 billion litres of waste water annually discharged by the distilleries (Chindankumar *et al.*, 2009).

Generation of spent wash:



This waste water is discharge directly into water bodies which cause water pollution. Different environmental regulatory bodies worldwide have already set norms for the waste discharge from industries. In India, for instance, distillery industry had been told to achieve zero discharge of spent wash by December 2005 according to charter of Central Pollution Control Board, the apex of pollution control authority (CPCB, 2003).

Characteristics of distillery spent wash:

Distillery spent wash is of purely plant origin and contains large quantities of soluble organic matter and plant nutrients. It does not contain any toxic material or compound (Baskar *et al.*, 2003). The spent wash is acidic and loaded with organic and inorganic salts. Being plant origin, the spent wash contains considerable amount of plant nutrients and organic matter (Sindhu *et al.*, 2007). It is of foul smelling, dark in colour (Hati *et al.*, 2005) and an acidic effluent rich in organic carbon, K, Ca, Mg and S, considerable amount of N, P, traces of micronutrients *viz* Fe, Mn, Zn and Cu and traces of sugar are also observed (Saliha *et al.*, 2005). Presence of appreciable amount of plant growth promoters *viz* gibberellic acid (GA) and indole acetic acid (IAA) have also been detected which further enhance the nutrient value of spent wash (Santiago and Bolan, 2006). The only problem with spent wash is its high BOD and COD content that deteriorate water as this waste water is discharge into water bodies.

Table: characteristics of spent wash

Parameter	Value	BIS value
Colour	Reddish brown	None
Total solids	60000-70000 mg/l	2100 mg/l
Total dissolved solids	12000-14000 mg/l	2100 mg/l
pH	3-5	5.5-9

Dissolved oxygen	Nil	4-6
Biochemical oxygen demand	30000-40000 mg/l	30 mg/l
Chemical oxygen demand	75000-80000 mg/l	250 mg/l

Source: Pandey *et al.*, 2007

Pollution potential of spent wash:

The distillery spent wash in general practice discharge into local water bodies which cause pollution in water, underground water and soil (Kumar *et al.*, 1994). It also effects the aquatic life of these water bodies. A similar experiment was carried out by Singh, 2008 on fresh water fish sp. Viz *Cyprinus carpio var. Communis* and investigate bio-toxicity of spent wash. When this polluted water is used for irrigation purpose it directly or indirectly affect the growth and productivity of plants like pea, wheat (Pandey *et al.*, 2009), rice (Sindhu *et al.*, 2007), Lady's finger (Pandey *et al.*, 2009), legumes (Baskar *et al.*, 2003) and others.

Solution of the problem:

The distillery waste water however does not consist of any toxic material but due to the high BOD and COD content, it cause pollution. The solution of the problem is discharge of waste water after proper treatment. The treatment type of spent wash includes biological, chemical and thermal. The chemical treatments are suitable for less quantity of spent wash but distilleries produces spent wash in huge amount. Further the thermal treatments are costly and with this treatment there is a probability of pollution too. So biological treatments are eco-friendly, safe and cheap. Three type of biological treatments are available, aerobic, anaerobic and composting. It has been observed that almost all distilleries have adopted anaerobic digestion as industry standard practice for the first stage treatment if raw spent wash. This will reduced the BOD and COD content of spent wash (Lekshmi, 2013). If land with suitable topography, soil characteristics and drainage is available, distillery spent wash can be put to good use as both source of irrigation water and plant nutrients. In most of the areas, water scarcity has forced the farmers to use this spent wash as a substitute of irrigation water (Mittal and Tawari, 2008). Irrigation with distillery wastewater seems to be an attractive agriculture practice, which not only augment crops yield but also provides a plausible solution for the land disposable of the spent wash. The spent wash contained N, P, K, Ca, Mg and S and thus valued as a fertilizer when applied to soil through irrigation with water (Samuel, 1986). Application of distillery spent wash should be done after proper dilution (1:10 to 1:50) with irrigation water or by pre-plant application (40-60 days before planting) (Baskar *et al.*, 2003).

Because of high concentration of organic load, distillery spent wash is a potential source of renewable energy. Due to high organic contents, the wastewater can be subjected for the production of biogas, bio-composting and potash recovery (Singh, 2008).

CONCLUSION

One of the most important environmental problem faced by the world is management of wastes. Distilleries industries in India pose a very serious threat to environment because of large amount of wastewater they generate which contain significant amount of recalcitrant compounds. The waste water produce by the distilleries constitutes a high organic and dissolved solid content, which results in environmental problems if remains untreated. Therefore it is necessary to discharge this waste material after proper treatment so that environment pollution can be reduced. In high concentrations of spent wash inhibitory factors were present which adversely affect the growth of the plant. Physicochemical characteristics

of soil are also affected adversely due to irrigation with higher concentration of spent wash. Besides conventional, biological and chemical treatments by the distilleries, the spent wash should be properly diluted with water before discharge on land and use for irrigation purposes as fertilizer. The utilization of distillery spent wash in agriculture would save cost on fertilizer, better crop productivity and facilitate reduction in pollution load on aquatic system.

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