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Producing Sustained Renewable Energy and Removing Organic Pollutants from Distillery Wastewater using Consortium of Sludge Microbes

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Abstract : Distillery wastewater in the form of spent wash is a complex and strong industrial effluent, with high load of organic pollutants that may deplete dissolved oxygen on being discharged into aquatic systems and contaminate groundwater by leaching of pollutants, while untreated spent wash disposed on land acidifies the soil. Stringent legislative measures have therefore been framed in different countries for discharge standards of distillery effluent. Utilising the organic pollutants present in various types of wastes as food by mixed microbial populations is emerging as an eco-friendly approach in the recent years, in which complex organic matter is converted into simpler forms, and simultaneously useful gases are produced as renewable and clean energy sources. In the present study, wastewater from a rice bran based distillery has been used as the substrate in a dark fermenter, and native microbial consortium from the digester sludge has been used as the inoculum to treat the wastewater and produce hydrogen. After optimising the operational conditions in batch reactors, sequential batch mode and continuous flow stirred tank reactors were used to study the best operational conditions for enhanced and sustained hydrogen production and removal of pollutants. Since the rate of hydrogen production by the microbial consortium during dark fermentation is influenced by concentration of organic matter, pH and temperature, these operational conditions were optimised in batch mode studies. Maximum hydrogen production rate (347.87ml/L/d) was attained in 32h dark fermentation while a good proportion of COD also got removed from the wastewater. Slightly acidic initial pH seemed to favor biohydrogen production. In continuous stirred tank reactor, high H₂ production from distillery wastewater was obtained from a relatively shorter substrate retention time (SRT) of 48h and a moderate organic loading rate (OLR) of 172 g/l/d COD.

Keywords : distillery wastewater, hydrogen, microbial consortium, organic pollution, sludge
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