

Microbial bioremediation of sulphate



Sulphate is a common pollutant in domestic waste, tannery and mining industry effluent which if left untreated causes environmental degradation and also human health problems. A microbial formulation has been developed which has the potential for treating effluents and removing more than 50% sulphate from starting concentration of 2000ppm within 4hours. The consortium has been characterized and the system has been scaled up to 220 lit in series. The consortium could stick equally well on steel and plastic matrices to form biofilm based bioreactor. The biofilm developed rapidly and was sustained. The microbes in the biofilm utilize the carbon source (lactic acid) during reduction of sulphate while releasing inhibitors which prevent further reduction of sulphate from the effluent on prolonging the time of incubation with the bacterial biofilm. A single unit bioreactor would be best for this application as columns in series would need substantial dilution of effluent at each step before being passed on to the next column for further reduction. Since it is the fastest consortium of SRB reported till date, it has potential for application. The technology has been filed as an Indian patent (1289/KOL/2013, dt 13thNov 2013) and as a PCT (PCT/IB2014/065982 dt 24th Dec 2014).

A further modification of the system had been developed whereby the bioreactor has been made self sustained by coupling it with another bioreactor which produces lactic acid by indigenously isolated microbe and the outlet of the first is connected to the second and works as a carbon source for the second bioreactor and makes the process self sustainable. This concept has been filed as a patent [789/KOL/2011 dt June 10th, 2011; PCT Application No. PCT/IB2011/001743 dated July 28, 2011; U.S. Patent 8398856 dt 19th March 2013] and the technology has been transferred to Intellectual Ventures Invention Network.

Reactor Type	Volume	Matrix Material	Lactic acid (mM)							
			24 hrs		36 hrs		48 hrs		60 hrs	
				mean		mean		mean		mean
Cylinder	777.85 cm ³	50 g hay	78.32 84.28 76.65	79.75	30.24 31.17 32.39	31.26				
Corrugated sheet	5616 cm ³		56.60 49.93 46.50	51.01	89.22 80.57 97.99	89.26	2.24 4.17 4.81	3.74	3.44 1.51 2.57	2.50
Cuboidal	5329 cm ³	460 g hay	91.16 93.94 92.03	92.37	97.08 96.78 96.84	96.9	98.2 154.6 140.8	131.2	120.82 128.66 79.57	109.68

Production of lactic acid by LAB in three different bioreactor designs.