



COMMENT

Comment on "Evaluation of dechlorination mechanisms during anaerobic fermentation of bleached kraft mill effluent", by W. J. PARKER, E. R. HALL and G. J. FARQUHAR, *Wat. Res.* 27, 1269-1273 (1993).

This paper is very interesting from the point of view of dechlorination of organochlorine compounds from kraft mill effluent. It appears from the Introduction that the authors attempted to establish the dechlorination mechanisms of organochlorine compounds from an angle of nucleophilic substitution. However, the results of their investigation are self contradictory (see p. 1271, Results and Discussion) as it is stated "However, the impact of sulfur compounds on the degradation of adsorbable organic halides (AOX) during anaerobic biological treatment of bleach plant effluent cannot be directly determined since sulfur compounds are present in this stream as a residual of the kraft pulping process".

The data reproduced in Table 1 do not seem to be very authentic as the method of preparation of the chlorinated organic matter is not efficient enough to produce good recovery of organochlorine compounds. As indicated in the text, chlorinated organic matter was adsorbed into the XAD-4 and XAD-7 resins and desorbed by 1000 ml methanol. It clearly shows only 51% recovery of AOX which is too low to be considered for evaluation of such mechanisms. In fact, adsorption of organochlorine compounds was found to be most efficient with XAD-2 resin (Sarkar and Sen Gupta, 1989). Moreover, there was no indication of proper standardization of the method of elution of the organochlorine compounds adsorbed on the surface of the resins. The elution of organochlorine compounds was found to be very efficient with methanol followed by dichloromethane and hexane (Sarkar and Sen Gupta, 1989). The authors should have standardized the method of isolation of the different organochlorine compounds from the effluent and undergone various steps of purification of the extract and its recovery followed by identification and quantitation of those compounds with the help of GC-ECD and GC-MS. The method of recovery has not been found to be efficient at all. They should have improved the recovery of organochlorine compounds by employing a different resin (e.g. XAD-2) and determined the elution pattern of the different compounds so as to assess the recovery of the different compounds.

The authors tried to interpret their results, on the basis of the similarities of the removal patterns of AOX in different studies, that the composition of chlorinated organic matter isolated by resin adsorption and methanol elution was similar in nature to that of whole wastewater (see first paragraph, p. 1272). However, they could not justify the actual mechanism of dechlorination of the organochlorine compounds by a systematic method of determination of the concentration of each of the components produced in the effluent. The authors should have indicated explicitly the type of organochlorine compounds being formed in the effluent, e.g. polychlorinated biphenyls, chlorophenols, PCDD, PCDF, PCH, etc. along with a proper method of identification and quantification. The authors are very keen to evaluate the dechlorination mechanisms as a nucleophilic substitution but they did not provide any supporting data in favour of such mechanisms. It would have been highly justified if the authors had highlighted the reaction mechanism from an angle of the order of the reaction and its molecularity. In fact, it is evident from various studies that pulp and paper mills produce a variety of chlorinated organic compounds as a result of bleaching of lignins and other wood constituents with chlorine (Kringstad and Lindstrom, 1984). It has also been reported by different scientists that pulp and paper mill effluents contain chlorinated organic compounds of many classes and additional unique compounds continue to be identified (Kringstad *et al.*, 1981; Kuehl *et al.*, 1991; Lindstrom and Osterberg, 1986; Mckague *et al.*, 1988; Stromberg *et al.*, 1987; Stuthridge *et al.*, 1990). Effluents have been shown to be directly toxic to fish and to increase their susceptibility to other stressors (Tana and Nikunen, 1986). Compounds in these effluents vary widely in their persistence, bioavailability and toxicity (Neilson *et al.*, 1991; Suntio *et al.*, 1988).

The authors have indicated that the oxidation and reduction potential of the reaction content was well below that required for sulfate reduction (see second paragraph, p. 1272), but did not mention anything about the electrode potential of the reaction medium which would enable the reader to understand clearly the actual state of the reaction.

The authors could not measure the sulfide concentration (see first paragraph, Results and Discussion, p. 1271) but tried to evaluate the mechanisms of dechlorination of the organochlorine compounds on the basis of stoichiometric reduction of the initial concentration of sulfate. Such a vague interpretation cannot be considered as a scientific tool for evaluation of the mechanisms of dechlorination of organochlorine

compounds. On the other hand, in order to determine the mechanism of such a dechlorination process, a kinetic study should have been carried out with an appropriate method of analysis. It would be highly appreciated if the authors would discuss the above points in detail for the benefit of the readers of this highly esteemed journal.

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