PART III

NOTES AND ABSTRACTS

NOTES:

CHITOSAN AS A WATER CLARIFYING AGENT

Chitosan is obtained by deacetylation of chitin with strong alkali. It is known to have very wide uses in textiles, pharmaceuticals and cosmetics (William, 1959). Riccardo Muzzarelli and Ottario Tubertini (1970) reported the use of chitin and chitosan as chromatographic supports and adsorbants for collection of metal ions from organic and aqueous solutions and sea water. According to them chitosan gives higher adsorption values than does chitin. This note describes the use of chitosan as a water clarifying agent. Presently for clarification of water aluminium and potash alums are employed. Although the alums are well known chemicals for their property of clarifying muddy waters, they are not very efficient in reducing the bacterial load of the water after the treatment. Treatment with chitosan is found to have the effect of bringing down the bacterial load of the contaminated water during clarification.

Water drawn from natural sources like river, pond and lake contains a number of impurities. Hence pretreatment of the water for the removal of the suspended impurities and harmful bacteria assumes importance in all the water supplying operations. Raw water normally contains harmful bacteria capable of causing water borne diseases such as cholera and typhoid and also those which bring about food spoilage. These bacteria have to be removed to make the water potable.

Chitosan used in this study was prepared as per the method described by Radhakrishnan & Prabhu (1971) using alcoholic sodium hydroxide.

A 1% solution of chitosan in 1% acetic acid was prepared and employed for the clarification purposes. Chitosan was added at 10ppm. level to water contaminated with added bacteria and allowed to stand for 45 minutes. The bacterial load was determined after 45 minutes. Muddy water used in this study was prepared by suspending finely ground brick powder in ordinary water. Cultures of *E. coli.*, Staphylococci and a mixture of these two were inoculated separately into the muddy water. After adding the inoculum, the initial bacterial load of the muddy water was determined. Treatments with chitosan and alum at 10 ppm. level were separately tried and the water allowed to stand for 45 minutes. The bacterial load after 45 minutes were determined in each case including the control. Bacterial load of the sediments also was determined in

TABLE I

Effect of treatments with chitosan and potash alum on water contaminated with Staphylococci.

Bacterial load per ml. of water after 45 min.		
Contral	Treatment with chitosan 10 ppm. level.	Treatment with alum 10 ppm. level.
6.1×10^5	8.5×10^3	1.9×10^4

TABLE II

Effect of treatments with chitosan and alum on muddy water contaminated with added Staphylococci.

A

Initial bacterial load/ml.	Bacterial load/ml. of water after 45 min.		
	Control	Chitosan treatment 10 ppm. level	Alum treatment 10 ppm. level
8.2×10^5	5.6×10^5	760	$1.0 \times 1C^5$

B

Bacterial load per ml. of sediments after 45 min.	
Chitosan treatment 10 ppm. level	Alum treatment 10 ppm. level
1.2×10^5	$2 2 \times 10^4$

TABLE III

Effect of treatment with chitosan and alum on muddy water contaminated with added *E. coli.* & Staphylococci.

Initial bacterial load/ml.	Bacterial load per ml. of water after 45 min.		
	Control	Chitosan treatment 10 ppm. level	Alum treatment 10 ppm. level
6.8×10^5	3.6×10^5	100	1.9×10^5

TABLE IV

Effect of time of treatment with chitosan on bacterial load of water. (Inoculum - *E. coli*)

Initial bacterial load per ml. muddy water	Bacterial load per ml. of water			Bacterial load per ml. of un-treater water after 45 min.
	After 15 min.	After 30 min.	After 45 min.	
1.45×10^5	1120	400	390	1.28×10^5

the case of the chitosan and alum treated samples.

From Table I it can be seen that the reduction in the bacterial count in ordinary water contaminated with added bacteria, after chitosan treatment is not appreciable although the bacterial load is less in water treated with chitosan than in water treated with alum. In the case of muddy waters, the efficiency in clarification and reduction of bacterial load is surprisingly high with chitosan treatment rather than with alum (Tables II to IV). This may perhaps be due to the property of chitosan to precipitate in slightly alkaline waters and in doing so coagulate the heavier particles of mud along with bacteria and settle down faster. That the bacteria settle down along with the suspended materials can be seen from the very high bacterial load of the sediments obtained after treatment.

Chitosan appears to have superior qualities as a coagulant and consequently as a water clarifying agent, especially for waters heavily contaminated with suspended materials and bacteria. Spectacular property of chitosan in bringing down the bacterial load in water by coagulating and sedimenting the bacteria along with other suspended particles can be efficiently employed in purification of contaminated water. The application is simple and time taken for clarification is short.

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Central Institute of Fisheries Technology,
Willingdon Island,
Cochin-682003.

P. V. Prabhu,
A. G. Radhakrishnan,
T. S. G. Iyer.