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Original Research Paper

Coagulation-Clarification of Turbid Coloured Water by Natural Coagulant (*Moringa oleifera*) Seed Extract

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ABSTRACT

Performance of *Moringa oleifera* seed extract as primary coagulant and as coagulant aid with alum in clarification of turbid coloured water was examined and compared with the performance of alum. *M. oleifera* seed extract is effective as prime coagulant and as coagulant aid with alum. Compared with alum (residual filtrate turbidity 2 NTU and residual colour 3 TCU), it produces water with slightly higher residual filtrate turbidity (4 and 3 NTU) and residual colour (15 and 13 TCU), but the residual turbidity and residual colour are within the WHO drinking water guideline values for turbidity (5 NTU) and colour (15 TCU).

INTRODUCTION

Natural polyelectrolytes of plant origin have been used for many centuries in developing countries for clarifying turbid water (Schulz & Okun 1984). For home water treatment, the materials have to be used in the form of powder or paste, 90% of which consists of substances other than the polyelectrolytes. Even under such conditions, a few plant seeds make effective coagulants (Jahn 1988). In laboratory and field studies, *Moringa oleifera* seed extract has shown promise as coagulant in the clarification of turbid water (Jahn 1988, Sutherland et al. 1990, Sutherland et al. 1994, Folkard et al. 1995, Al-Khalili et al. 1997, Ndabigengesere & Narasiah 1998, Folkard & Sutherland 2002). A method for home water treatment comprising coagulation by *M. oleifera* seed extract and filtration through a meshed sand filter or a sand-charcoal filter was suggested (Jahn 1981, Setyawaty 1989). In laboratory tests, direct filtration of turbid surface water with *M. oleifera* seed extract as coagulant, produced substantial improvements in its aesthetic and microbiological quality (Babu & Chaudhuri 2005). However, examination into the performance of *Moringa* seed extract in coloured waters is warranted (Dorea 2006) because, when used as primary coagulant, polyeletcrolytes may not be as effective as metallic salts to treat water with significant amounts of colour-causing organics (Letterman et al. 1999).

In the present study, performance of *Moringa oleifera* seed extract as primary coagulant and as coagulant aid with alum in clarification of turbid coloured water was examined and compared with the performance of alum.

BATCH COAGULATION-CLARIFICATION TEST

Batch coagulation-clarification test was performed in a six-paddle jar test apparatus by flash mixing of the coagulants with Sg. Perak water (Turbidity 47-48 NTU; pH 6.5-7.2; spiked with natural coloured water to true colour 43-46 TCU) at 100 rpm for 1 min followed by slow mixing at 20 rpm for 20 min and quiescent settling for 30 min. A filtration step (filtration of supernatant through Whatman

No. 40 filter paper) was incorporated to predict filtered water quality in batch coagulation-clarification test as recommended by Hudson & Wagner (1981). Coagulants were alum [$Al_2(SO_4)_3.16H_2O$] and *M. oleifera* seed extract. *M. oleifera* seed extract (2%) was prepared by pounding kernels of dried *M. oleifera* seeds in a mortar to a pasty powder, suspending the powder with distilled water and filtering through Whatman No. 40 filter paper.

RESULTS AND DISCUSSION

Fig. 1 shows the results of the coagulation-clarification test with alum as primary coagulant. At alum dose of 25 mg/L there was residual supernatant turbidity of 4.5 NTU, residual filtrate turbidity of 2 NTU and residual colour of 3 TCU.

Fig. 2 shows the results of the coagulation-clarification test with *M. oleifera* seed extract as primary coagulant. At *M. oleifera* seed extract dose of 500 mg/L there was residual supernatant turbidity of 7 NTU, residual filtrate turbidity of 4 NTU and residual colour of 15 TCU.

Fig. 3 shows the results of the coagulation-clarification test with alum as primary coagulant and *M. oleifera* seed extract as coagulant aid. At alum dose of 15 mg/L with *M. oleifera* seed extract dose of 80 mg/L there was residual supernatant turbidity of 8 NTU, residual filtrate turbidity of 3 NTU and residual colour of 13 TCU.

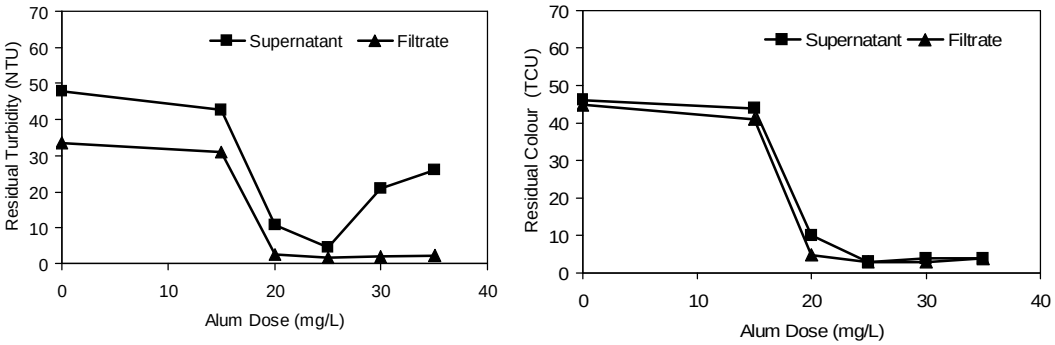

Fig. 1: Performance of alum in clarification of turbid coloured water.

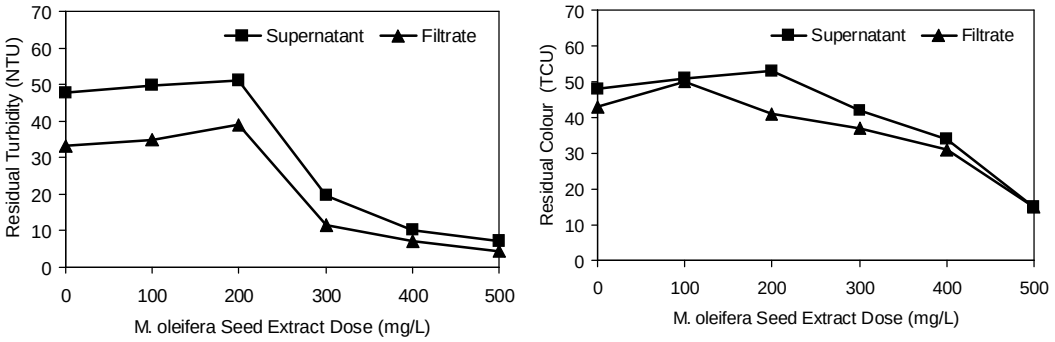

Fig. 2: Performance of *M. oleifera* seed extract in clarification of turbid coloured water.

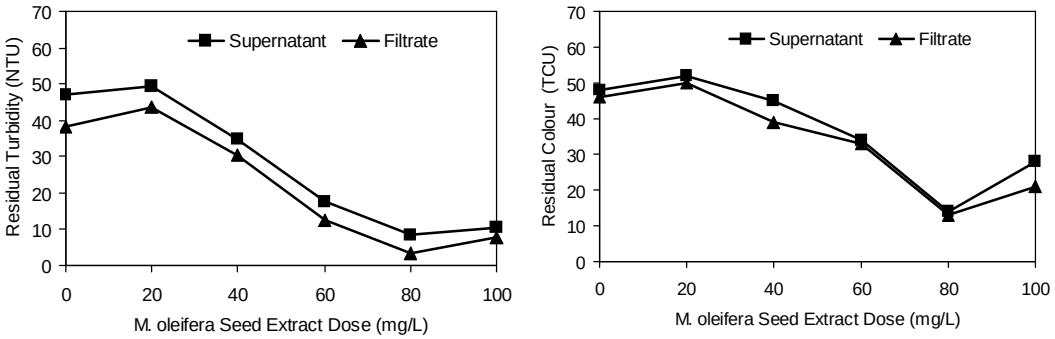

Fig. 3: Performance of *M. oleifera* seed extract as coagulant aid with 15 mg/L of alum in clarification of turbid coloured water.

M. oleifera seed extract is effective as prime coagulant and as coagulant aid with alum in clarification of turbid coloured water. Compared with alum (residual filtrate turbidity of 2 NTU and residual colour of 3 TCU), it produces water with slightly higher residual filtrate turbidity (4 and 3 NTU) and residual colour (15 and 13 TCU), but the residual turbidity and residual colour are within the WHO (2006) drinking water guideline values for turbidity (5 NTU) and colour (15 TCU).

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