



# STUDIES ON THE EFFECT OF MORINGA AND VETIVER ON WATER PURIFICATION

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**Abstract:** In this study phytoremediation of wastewater by Moringa and Vetiver was conducted. Various doses of *Chrysopogon zizanioides* (Vetiver) root powder and *Moringa oleifera* seed powder were taken for the study. 50mg/litre, 100mg/litre, 150mg/litre concentration were taken, checked and analyzed on various water quality parameters like P<sup>H</sup>, turbidity, TDS, hardness, alkalinity, acidity, MPN. All parameters were decreased with increased doses of plant extracts except P<sup>H</sup>. But maximum purification efficiency was shown by Vetiver as it made a drastic decrease in the MPN index, TDS and Hardness. That means Vetiver has more water purification capacity than Moringa.

**Index Terms - Phytoremediation, water purification, Moringa, Vetiver.**

## I. INTRODUCTION

Moringa seeds have been recommended for water treatment in Africa & in south Asian countries. According to Jahn, 1998 the seeds of Moringa is very efficient in water purification without side effects. In the opinion of Emelie *et al.*, 2007, it is most effective as a primary coagulant for water treatment. Both a xerophyte and a hydrophyte, Vetiver can withstand extreme drought perhaps owing to high salt content of its leaf sap as well as long periods of inundation. It has been found to be unaffected by temperature as low as -9 °C (Grimshaw, 1997). Additionally, a portion of the research is focused on the practical application of this appropriate technology for household water purification.

## II. MATERIALS AND METHODS

### Sample collection

Canal water, well water and plant materials were collected from Thiruvathukal region 5 kms away from Kottayam, Kerala state.

### Treatment with Moringa seeds and Vetiver roots

The plant materials were washed, dried in shade and powdered. Water samples were treated with different concentration of plant extracts such as 50mg/500ml, 100mg/500ml, and 150mg/500ml for 24 hours. Water quality parameters such as microbial, physical and chemical were analysed before and after treatment. To determine Most Probable Number (MPN), Lactose broth was used for detection of presence of coli form in water samples. Lactose broth was prepared for in double strength and single strength concentration 10ml from sample was inoculated in to double strength groups containing inverted Durham's tubes, 1ml into 3 single strength tubes and 0.1ml into 3 single strength tubes. All the tubes were incubated at 37°C for 24-48 hrs. After incubation, the tubes were observed for acid and gas production. Total number of coli form bacteria per 100 ml was determined as per the standard chart of WHO.

Acidity, Alkalinity and hardness were estimated by titration using NaOH (0.02N), Hcl (0.02N), AgNO<sub>3</sub> (0.02N) respectively. PH, TDS and electrical conductivity were tested using water analyser

## III. RESULTS AND DISCUSSION

MPN before treatment was very high and in a range of 2400+. Then it is decreased when the water samples were treated with various doses of plant extracts. All parameters were decreased with increased doses of *Moringa oleifera* and *Chrysopogon zizanioides* except P<sup>H</sup>. But Vetiver decreased the MPN index, TDS and Hardness significantly. That means Vetiver has more water purification capacity than Moringa. Maximum purification efficiency is in 150mg/500ml concentration for both plant extracts. Table 1 shows MPN values of samples before and after treatment with plant extracts. The value highly decreased after treatment as shown in Fig.1 and the water became potable for drinking.

Table 1: Showing MPN of two water samples before and after treatment with *M.oleifera* and *C.zizanioides*

PLANT	Sample number	Before treatment	After treatment		
			50mg/500ml	100mg/500ml	150mg/500ml
<i>C. zizanioides</i>	Sample1	2400	1100	170	25
	Sample 2	2400	1600	150	21
<i>M.oleifera</i>	Sample1	2400	2400	1100	29
	Sample 2	2400	2400	1600	34

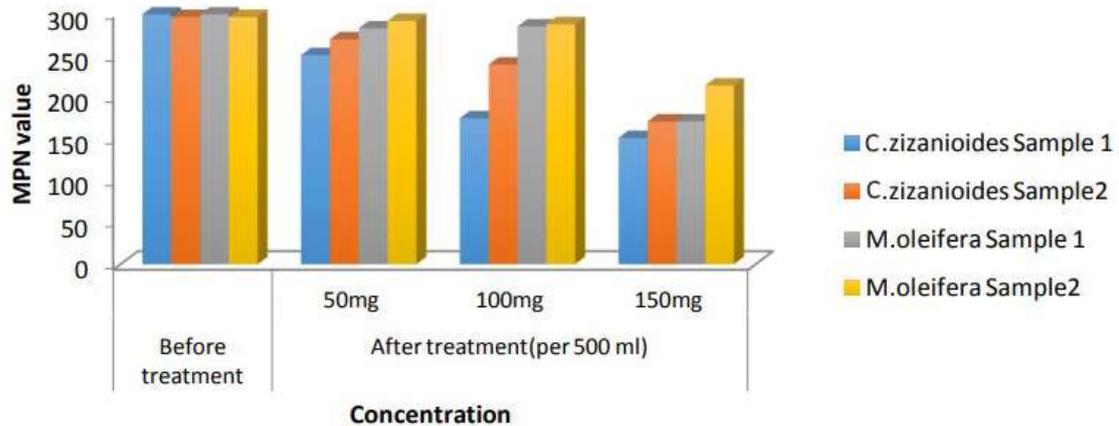


Fig.1: MPN of two water samples with various doses of *M. oleifera* and *C.zizanioides*

Table 2 shows P<sup>H</sup> range of different water samples before and after treatment with various doses of extracts. The samples were having P<sup>H</sup> range in between 6.3-8.5. After treatment P<sup>H</sup> value is highly maintained as shown in Fig.2.

Table 2. P<sup>H</sup> of two water samples before and after treatment with various doses of *M. oleifera* and *C. zizanioides*

PLANT	Sample number	Before treatment	After treatment		
			50mg/500ml	100mg/500ml	150mg/500ml
<i>C. zizanioides</i>	Sample1	6.3	7.3	7.25	7.1
	Sample 2	6.2	7.29	7.14	7.08
<i>M.oleifera</i>	Sample1	6.3	6.3	6.29	6.95
	Sample 2	6.2	6.65	6.64	6.98

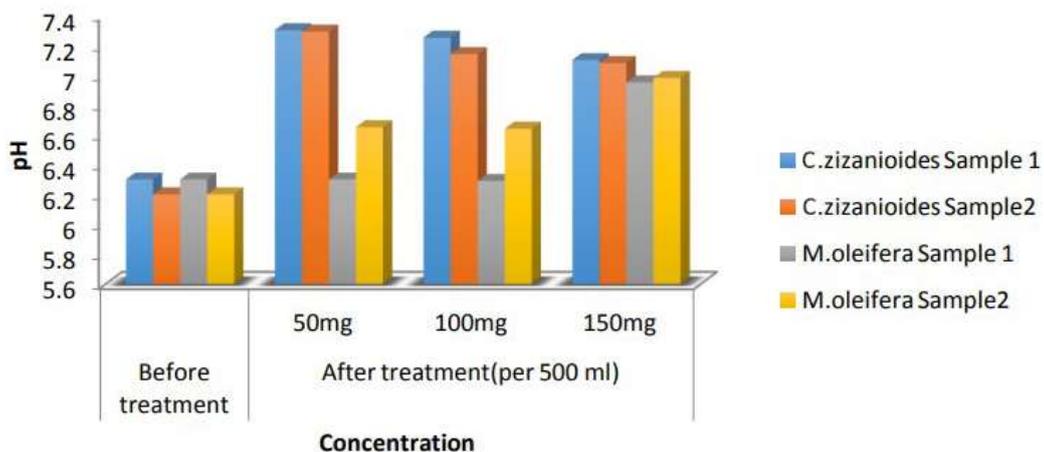


Fig.2: p<sup>H</sup> of two water samples before and after treatment with various doses of *M.oleifera* and *C.zizanioides*

TDS of untreated water sample is 82 and 91.9. Table 3 shows that it decreased to 60.2 and 62.2 when treated with Vetiver, and 32.8 and 50 in Sample 1 and Sample 2 respectively when treated with Moringa, which is visually represented in Fig. 3.

Table 3. TDS of two water samples before and after treatment with various doses of *M.oleifera* and *C.zizanioides*

PLANT	Sample number	Before treatment	After treatment		
			50mg/500ml	100mg/500ml	150mg/500ml
<i>C. zizanioides</i>	Sample1	82	68.5	60.01	32.8
	Sample 2	91.9	88	41	50
<i>M.oleifera</i>	Sample1	82	66.2	64.7	60.2
	Sample 2	91.9	65.2	67.2	62.1

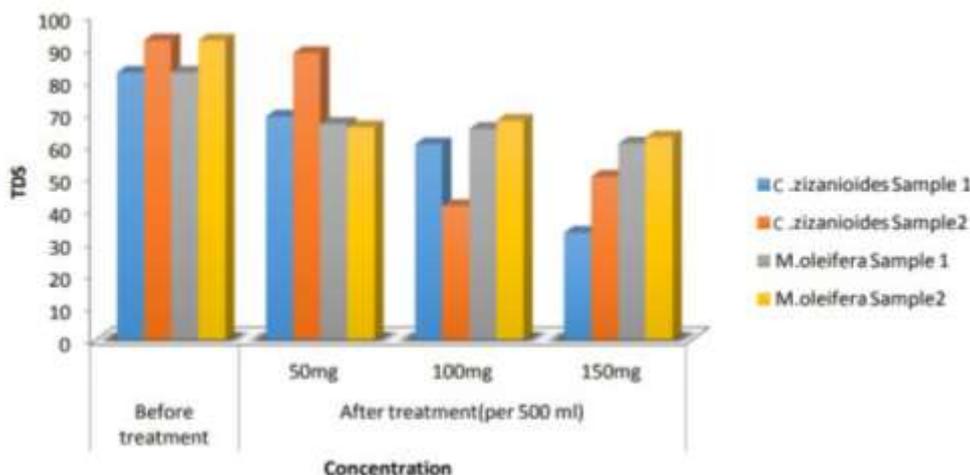


Fig. 3: TDS of two water sample before and after treatment with various doses of *M.oleifera* and *C. zizanioides*

The presence of dissolved CO<sub>2</sub> is usually the main acidity factor in surface water. Table 4 shows that acidity decreased when treated with both plant extracts.

Table.4 Acidity of two water samples before and after treatment with various doses of *M.oleifera* and *C.zizanioides*

PLANT	Sample number	Before treatment	After treatment		
			50mg/500ml	100mg/500ml	150mg/500ml
<i>C. zizanioides</i>	Sample1	40	38	15	6
	Sample 2	50	34	25	5
<i>M.oleifera</i>	Sample1	40	28	18	10
	Sample 2	50	38	20	8

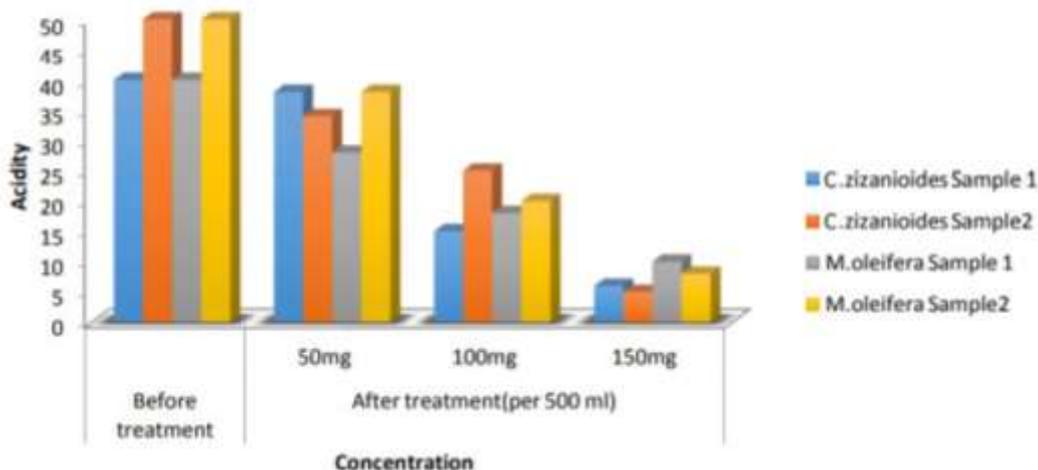


Fig.4: Acidity of two water samples before and after treatment with various doses of *M.oleifera* and *C.zizanioides*

Alkalinity of water may be due to the presence of one or more number of ions. These includes hydroxides, carbonates and bicarbonates. Table 5 shows that alkalinity of untreated water sample (79 and 75mg/liter) it is decreased to 40 and 36mg/liter with Vetiver and 48 and 32mg/litre when treated with Moringa.

Table.5 Alkalinity of two water samples before and after treatment with various doses of *M.oleifera* and *C.zizanioides*

PLANT	Sample number	Before treatment	After treatment		
			50mg/500ml	100mg/500ml	150mg/500ml
<i>C. zizanioides</i>	Sample1	79	60	50	40
	Sample 2	75	52	48	36
<i>M.oleifera</i>	Sample1	79	64	60	48
	Sample 2	75	56	52	32

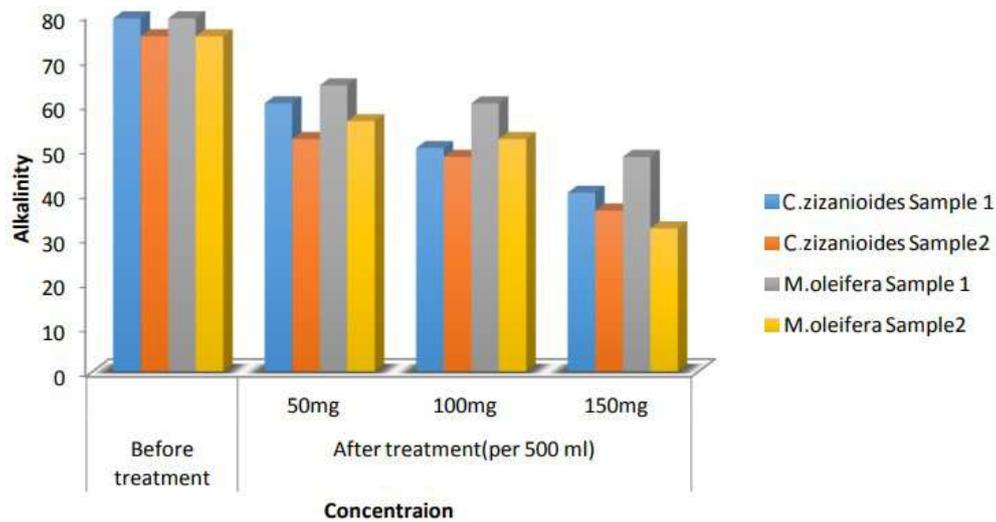


Fig.5: Alkalinity of two water sample before and after treatment with various doses of *M.oleifera* and *C. zizanioides*

Hardness of water is due to the presence of Ca and Mg salts. Table 6 shows that hardness is decreased to 62 and 90 when treated with Vetiver and 64 and 98 when treated with Moringa. This shows that Vetiver has more efficiency in reducing hardness.

Table 6 Hardness of two water sample before and after treatment with various doses of *M.oleifera* and *C. zizanioides*

PLANT	Sample number	Before treatment	After treatment		
			50mg/500ml	100mg/500ml	150mg/500ml
<i>C. zizanioides</i>	Sample 1	100	94	76	62
	Sample 2	130	122	110	90
<i>M.oleifera</i>	Sample 1	100	96	80	64
	Sample 2	130	124	118	98

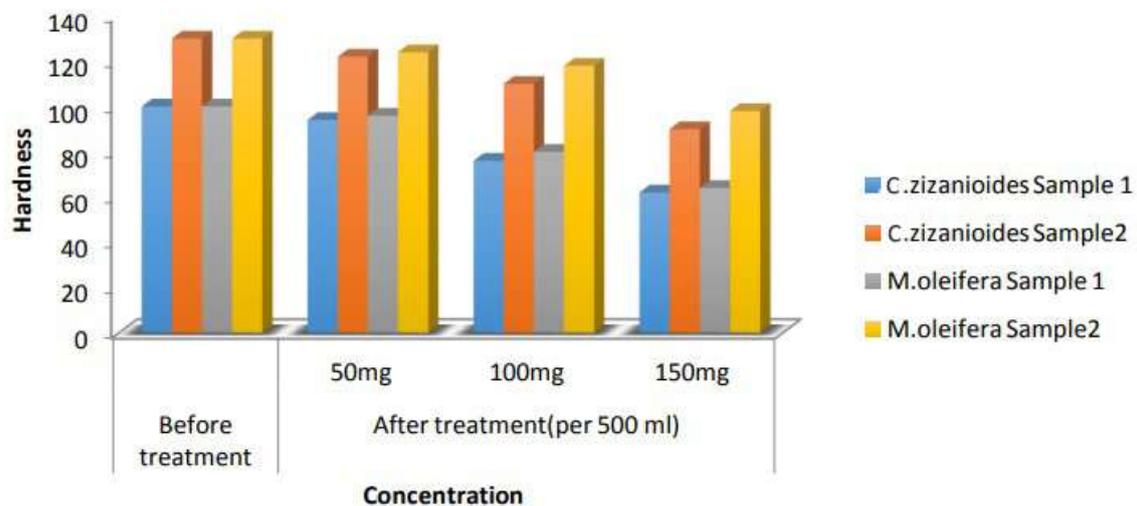


Fig.6: Hardness of two water sample before and after treatment with various doses of *M.oleifera* and *C.zizanioides*

Conductivity of water is due to the presence of soluble salts or their ionic Contaminants. Table 7 shows that conductivity of untreated water sample is 297.66 and 294.6. After treatment its value decreases to 150.5 and 170 when treated with Vetiver and 170.2 and 213 with Moringa.

Table.7 Electrical conductivity of two water samples before and after treatment with various doses of *M.oleifera* and *C.zizanioides*

PLANT	Sample number	Before treatment	After treatment		
			50mg/500ml	100mg/500ml	150mg/500ml
<i>C. zizanioides</i>	Sample 1	100	94	76	62
	Sample 2	130	122	110	90
<i>M.oleifera</i>	Sample 1	100	96	80	64
	Sample 2	130	124	118	98

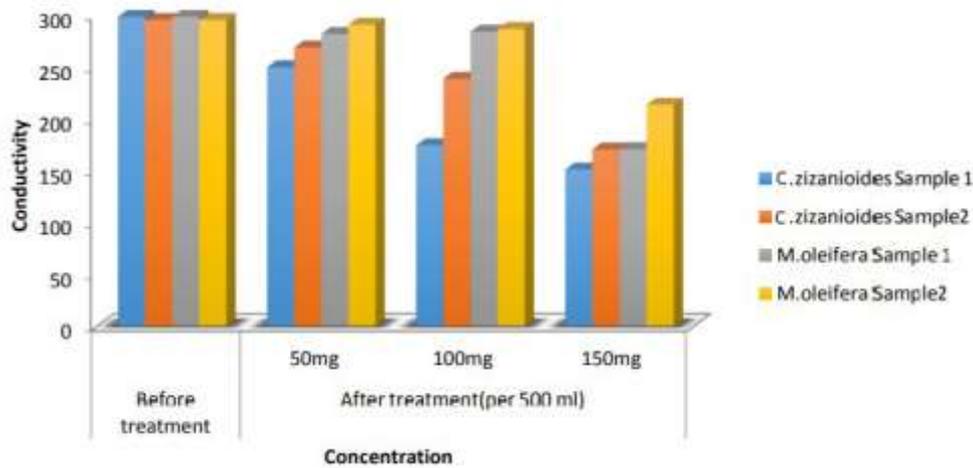


Fig.6: Conductivity of two water sample before and after treatment with various doses of *M.oleifera* and *C.zizanioides*

The results from this study showed that these plant extracts can be used for cost effective and eco-friendly water treatment methods. Moringa and Vetiver have the ability to lower and maintain ideal  $P^H$  level, TDS, electrical conductivity, and also regulate acidity, alkalinity, hardness, thus purifies the water.

The MPN test had shown positive which indicates the water samples are faecal contaminated and not safe for drinking. We can clearly see that the MPN was reduced after treatment with *Moringa oleifera* and *Chrysopogon zizanioides*.

#### IV. CONCLUSION

The present work reveals the ability of Moringa and Vetiver as phytoremediation agents. Implementation of this low cost method is recommended for ecofriendly, non-toxic simplified water treatments where rural and peri-urban people living in extreme poverty are presently drinking highly turbid and microbiologically contaminated water.

#### V. REFERENCES

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