

## Application of *Moringa oleifera* Seed Powder for Coagulation of Iron (III) on Local Water Resources

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### ABSTRACT

This paper reports the potential application of moringa seed's powder as iron coagulant to improve source of drinking water quality. Moringa seed powder was studied by optimizing the coagulation of iron toward variation of mass from moringa seed's powder and precipitation time. Water sample was taken from local water sources in Malang, East Java, Indonesia. The result gives a high potential application for moringa's seed powder as coagulant for iron in local drinking water sources.

Key word: *Moringa oleifera*, Iron, Coagulation

### INTRODUCTION

Iron is one of elements can be found abundantly in the earth, include contains in water sources with various quantity. It dissolved in water as iron(II) or iron(III). Beside that for drinking water, iron contained water not only from underground, but also comes from other sources, such as dissolution of iron pipe, water reservoir of iron, and industrial waste sludge. If iron concentration dissolves in water source for drinking water above the standard from Department of Health Republic of Indonesia (*Permenkes* No. 416 /Per/Menkes/IX/ 1990) [1], it causes a public health problem. Because human body will not be able to secrete iron, and in some cases for whom oftenly get a blood transfusion their skin look darker due to iron accumulation in the body. Drinking water contains of high iron can cause a nausea, moreover, in the high doses, it can injure colon. Mortality is often caused by the injury of colon itself [6].

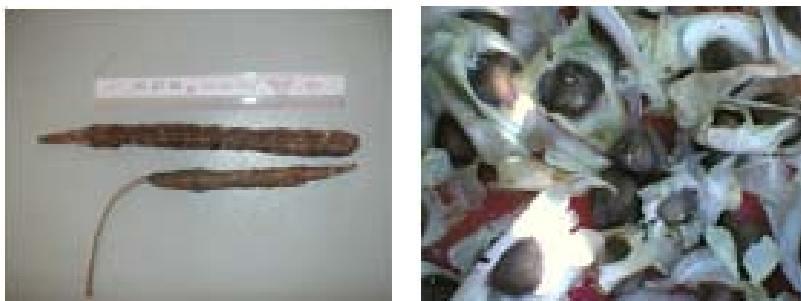


Figure 1. *Moringa Oleifera*

Moringa seed is organic polymer which possesses coagulant. Moringa seed contain of active compound that has high reactivity and has a polyelectrolyte character. As polyelectrolyte, Moringa seed can be used for coagulating of dissolved metal ions, [2], [3], [4], [5]. Since it's harmless and naturally easy to biodegrade, thus moringa's seed is potential to be used as coagulant to rise up the quality of raw water of drinking water [6].

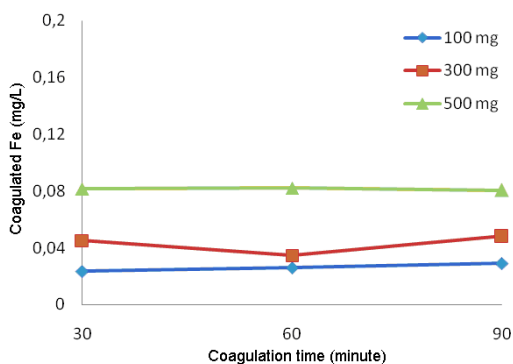
## EXPERIMENT

### Chemicals and instrumentation

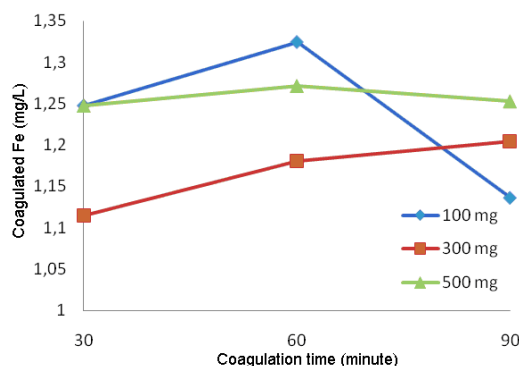
Chemicals used for research were standard solution of Fe (Merck) and *Moringa oleifera* Seeds from Local Resident in Madyopuro, Malang, Indonesia. Water samples were taken from well water (Sumbersari, Malang), Brantas river (Betek, Malang), and water tap from local water company (PDAM, Malang). Instrumentation for analysis was AAS (Shimadzu Atomic Absorption Flame Emission Spectrophotometer AA-6200).

### Experimental procedure

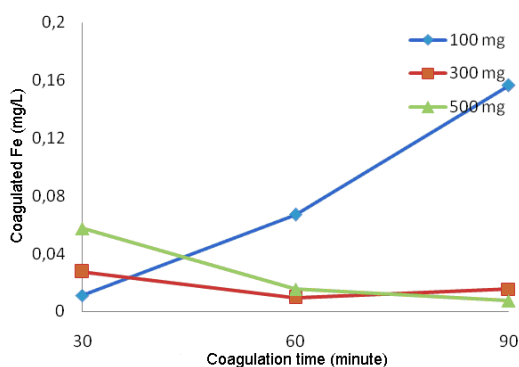
The standard solution of iron was prepared from 0.10 to 0.50 ppm and its absorbances were determined by AAS. Then, each sample of water after treatment process with moringa's seed powder was analyzed and measured their absorbance value.



**Figure 2** (Above) Absorbed iron by moringa seed's powder in variation of time (sample from well water)



**Figure 3** (Right-above) Absorbed iron by moringa seed's powder in variation of time (sample from river water)



**Figure 4** (Right). Absorbed iron by moringa seed's powder in variation of time (sample from PDAM water)

## RESULT AND DISCUSSION

### The effect of mass coagulant of moringa's seed powder and precipitation time

The mass of moringa's seed powder and coagulation time during coagulation process give affect on iron concentration. Mass variation of moringa's seed powder was performed in

100, 300, and 500 mg. Meanwhile the coagulation process was performed from 30 to 90 minutes. The result is shown in Figure 2-4.

The analysis of the coagulated iron from well water sample by moringa's seed powder was achieved optimum when 500 mg of it was added on the water sample with 60 minute coagulation. The final concentration of iron was recorded at 0.0014 mg/L, or the moringa's seed powder was able to reduced iron contained by 98.32%. Meanwhile for 100 and 300 mg addition of powder, they were given similar pattern but in lower level of iron absorption.

The optimum coagulation of iron concentration from the river water sample was provided when 100 mg of moringa's seed powder was used, and coagulation time 60 minute. The iron final concentration was calculated as 0.046 mg/L, or it was able to reduce the iron concentration by 96.64%. Its activity was dropped after 60 minute precipitation. Meanwhile for 300 and 500 mg addition of moringa's seed powder, they give similar pattern. The coagulation of iron goes up by increasing of the coagulation time. But, it was in the lower level than that with 100 mg addition.

Different pattern was observed when waster sample was from local water company (PDAM). The optimum coagulation was achieved when total concentration of iron recorded when using of 100 mg moringa's seed powder, and precipitation time for 90 minute. It was able to detect iron final concentration 0.045 mg/L, or 25.62% reduction compare to the initial concentration. The coagulation activity goes down for addition 300 and 500 mg of the powder with increasing precipitation time.

For obtaining optimum mass of moringa's seed powder as coagulant and coagulation time toward increasing water quality was used descriptive test of MANOVA statistic with value  $\alpha = 0.05$ . It was been concluded that dissimilarity of optimum mass and precipitation time for different water sources. Each water sources have a different quality level, so that the treatment applied is different as well.

**Table 1.** Optimum mass and precipitation time

Water Source	pH	Mass (mg)	Precipitation time (minute)	Reduction (%)
Well	7.0	500	60	98.32
River	6.8	100	60	96.64
PDAM	7.0	300	90	25.62

The percentage of iron reduction in all water quality in each water source is different. Particles coagulant suspended by moringa's seed powder is affected by negative charge colloid in destabilization process by polyelectrolyte. The most possible mechanism happening during coagulation process is absorption and charge neutralization [6]. The use of moringa's seed powder as coagulant in raw water sources for local drinking water gives a promising result toward the three sources of water samples.

According to the data obtained, the increasing quality of raw water for drinking water can be afforded because of coagulation process between moringa's seed powder and metal colloid. The mechanism of coagulation is caused by colloid destabilization or the repulsion force reduction from water parameter colloid. Colloid destabilization may occur by the addition moringa's seed powder as coagulant which has a different capacity compare to the water parameter colloid.

## CONCLUSION

Moringa seed's powder has activity as coagulant. It can significantly reduce the iron contained in water sources for local drinking water.

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