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Antibacterial activity of Moringa Oleifera Seed and its efficacy in the treatment of Water

Onyeulor P N[1], Irechukwu O E[1], Ugwuegbu A O[1], Chimereze N[2], Azubuike C[2]
[1] Department of Environmental and Biology, School of Industrial and Applied Sciences, Federal Polytechnic Nekede, Owerri, Imo, Nigeria
[2] Department of Biology and Microbiology, School of Industrial and Applied Sciences, Federal Polytechnic Nekede, Owerri, Imo, Nigeria

Abstract
Health is synonymous with wealth. Exploring the use of local content in analyzing and solving health related problems in an era of inflation is another way of being economically resilient, especially in a depressed economy. Again, a good laboratory investigation being sine qua non to successful treatment will minimize wastage of meager resources. In this study, the antibacterial activity of Moringa oleifera seed and its efficacy in water treatment was assayed. Moringa oleifera seed was purchased from a nearby market, dried and grinded into powder form using a sterile grinder. A known weight of the powder was added into a measured volume of water samples. They were incubated at different time intervals including controls. The samples were later subjected to both cultural, morphological and biochemical techniques to ascertain the antibacterial effect of the seed on bacteria load of the water. The results obtained showed five bacteria genera from the samples which included—*Escherichia, Klebsiella, Staphylococccus, Bacillus and Micrococcus* before and after addition of the M. oleifera seed powder. Also, the bacteria load of the water samples into which the M oleifera seed powder was added were higher than the samples with no M oleifera powder addition. The sample which had the longest exposure with M oleifera seed powder recorded more bacteria load (6.8 x 10^6cfu/ml.). It can therefore be concluded that M oleifera seed has no antibacterial activity on water isolates and hence cannot be used in water treatment. It can therefore be recommended that M oleifera seed when used for its nutritional value, should be complemented with antibacterial agents for treatment of bacteria related infections.

Keywords: Bacteria, load, molinga, seed

Introduction

Molinga oleifera, commonly calledmolinga, which is a native of north western India is widely cultivated in tropical and subtropical areas. It is widely consumed in Africa because of its nutritional and medical properties (Fahey, 2005) [4], (Olson and Rosell 2006) [9], As an oxidant, molinga seems to protect cells from damage, help to decrease inflammation and reduces pain (Libby.2002) [8], (Anhwange*et al*., 2004) [2]. (Kushwaha *et al*., 2014) [7]. In Africa, it is used in self-medication by people suffering from asthma, diabetes and other purposes (Abd Rani *et al*., 2018) [1]

Water, commonly used for different purposes including drinking by inhabitants in and around Federal Polytechnic Nekede, Owerri is either fresh surface water or ground water. This water acquires chemicals from different sources and the chemicals accumulate as dissolved or suspended solutes. (Bricker and Jones, 1995) [3]. The chemicals present in surface water can be of natural origin or anthropogenic sources like nitrates from fertilizers and bacteriological contamination from sewage (Hyde *et al*., 1989) [5] The presence of these chemicals and microorganisms in water may be detrimental to the health and general wellbeing of consumers. The use of Moringa seed powder (if effective) in the purification and treatment of these water samples will be cost effective as other ways of water purification and treatment are expensive.

Although Moringa seed has been known to possess high nutritional value, its antibacterial activity and its value as a water purifying agent has not been adequately studied. Again, few researches on the antibacterial activity of Moringa oleifera seed powder have conflicting results.

This research is therefore aimed at ascertaining the potency of Moringa oleifera seed powder as an antibacterial agent and its efficiency in the treatment of water.

Sample collection and handling

Sample collections was done using standard methods Two different samples A and B were collected from flowing water at two different sites from Otamiri river located at Umudibia in Owerri west local government area. PH, temperature and turbidity were measured at the collection sites in order to monitor chemical and physical characteristics of samples which are prone to change during transportation. The samples were collected into two sterile 5L capacity bottles and were taken to the laboratory for laboratory investigation.

Sample Treatment

Each water sample was treated with Moringa oleifera seed powder to ascertain the effect of time and quantity on its antibacterial activity and its potency as a purifying agent.

Effect of time on the activity of moringa oleifera seed power as a water purifying and antibacterial agent.

The water samples (A and B) were dispensed separately in 200ml volume into 5 different sterile bottles marked A-E.2g of dried ground Moringa seed power was added were added into the different water samples at 6hr intervals an immediately before culturing. The last sample bottle was left without moringa seed powder addition which served as control. The physical parameters of all the samples were recorded. Tenfold serial dilution of each of the samples from each bottle was made and 0.1g of 10^{-3} dilution was

cultured on a prepared Eosin Methylene Blue agar plates using spread plate technique. The plates were incubated at 37^{O}C for 24hrs. Both the physical parameters, morphological, bacteria load and biochemical characteristics of the samples were noted and recorded.

Effect of Quantity on The Activity of Moringa oleifera Seed Power as A Water Purifying and Antibacterial Agent.

Again**,** the water samples (A and B) were dispensed separately in 200ml volume into 3 different sterile bottles marked A, B and C. 2g of dried ground moringa seed powder was added to bottle A while 4g of powder was added to bottle B with C serving as control without seed powder addition. The treated samples were incubated at 28^{O}C for 6hrs. Tenfold serial dilution of each of the samples from each bottle was made and 0.1g of 10^{-3} dilution was cultured on a prepared Eosin Methylene Blue agar plates using spread plate technique. The plates were incubated at 37^{O}C for 24hrs. Both the physical parameters, morphological, bacteria load and biochemical characteristics of the samples were noted and recorded.

Results and Discussion

The results obtained from this study are as summarized on the tables.

Table 1 showed an increase in bacteria load with increase in time of exposure. Five bacteria genera were identified from the samples. These included Bacillus, Klebsiella, Staphylococcus, Micrococcus and Citrobacter

Table 1: Bacteria Load of Samples Based on Time of Exposure to Moringa oleifera Seed Powder

Samples	Time of M. oleifera Seed Powder Exposure	Bacteria Load(cfu/ml)	Bacteria Isolated
A	6.0pm	6.9 x 10^6	Bacillus species
	12am	6.2 x 10^5	Klebsiella spp
	6.0 am	5.4 x 10^5	Staphylococcus spp
	immediate	4.8 x 10^6	Micrococcus spp
	None/ control	5.0 x10^6	Citrobacter spp
B	6pm	4.2 x 10^6	
	immediate	2.2 x 10^6	
	None/ control	2.7 x10^5	

Table 2: Bacterial Load of Samples Based on Quantity/Dosage of Ground M. oleifera Seed Powder

Samples	Quantity of Ground M. oleifera Seed Powder Added	Bacterial Load	Bacteria isolated
A	2g	3.0 x 10^6	Escherichia coli
	4g	3.8 x 10^6	
B	2g	4.2 x 10^6	Staphylococcus aereus
	4g	3.6 x 10^6	Bacillus cereus
C	None/ control	3.2 x 10^6	

Table 3: some physiochemical parameters of samples before and after m. Oleifera seed powder addition

Samples	Parameters	Physical parameters before Moringa seed Powder addition	Physical parameters After Moringa Seed Powder addition
A	Colour	Off-white	Off-white
	Taste	Tasty	Tasty
	Odour	Foul	Foul
	Turbidity	6.2	3.3 NTU
	pH	6.8	6.7
	Temperature	28^{o}C	27^{o}C
	Conductivity	2480µS/cm	2250 µS/cm
	Total Dissolved Solid	11.2g	8.6
	Total Solid	12.28g	10.5

Discussion

The results obtained from this study made some revelations on this common seed of M. oleifera. The M. oleifera seed had the potency to reduce the turbidity and solute content of the assayed water samples although it did not totally remove them. Jahn *et al*. (1998) [6] had attributed this to the high seed protein content which has active coagulation properties that can be used in turbidity removal. The mechanism of coagulation with the seeds of M. oleifera consists of adsorption an neutralization of colloidal positive charges which attract the negatively charged impurities in water (Ndabigengesere and Narasiah, 1998). This result agrees with the findings of Subramaniam *et al.,* (2011) [10] who observed a reduction of turbidity of surface water samples by M. oleifera seed powder. However, the inability of the M. oleifera seed powder to have positive effect on the PH, colour, taste and odour of the water samples limits its use as a purifying agent since a portable water by World Health Organization (W H O) standard, must be tasteless, colourless and odourless.

Time of exposure and the dose of M oleifera seed powder in the water samples increased the bacteria load of samples but did not affect significantly, its antibacterial potency. The bacteria load of samples with the highest time exposure was high and in some cases higher than the ones with least time exposure as seen on table 1 and 2.This may suggest that the nutrients- vitamins, minerals (calcium, potassium and protein) and amino acids which are contained in the seeds may have the tendency to support the growth, survival and multiplication of bacteria in water.

Conclusion

From the results obtained in this research, it can be concluded that Moringa oleifera seed powder has the ability to reduce the turbidity and solute content of water but lack the potency to totally purify water, rendering it fit for consumption. Also M. oleifera seed powder has no anti-bacterial activity hence cannot be used as antibacterial agent. Time of exposure and dosage of the seed powder does not increase the effectiveness of M. oleifera as anti-bacterial agent.

Recommendation

Based on the outcome of this research, we recommend that M oleifera seed be used for its nutritive value but should be supplemented with other antibacterial and purification agents if it must be used in treating bacteria related infection and in treating water samples for consumption.

Conflict of interest

The authors declared that there is no conflict of interest regarding the publication of this manuscript

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