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The Effects of Epsom Salt on Microorganisms Isolated From Sewage

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ABSTRACT

The occurrence and distribution of pathogenic and non-pathogenic microorganisms in sewage maybe a public health concern with regards to disposal. Various sewage treatment methods exist but this study investigates the effectiveness of Epsom salt on sewage microorganisms. Serially diluted samples of sewage were surface plated on nutrient agar and potato dextrose agar for isolation of bacteria and fungi present. Four genera of bacteria; *Staphylococcus aureus*, *Escherichia coli*, *Klebsiellapneumoniae*, *Psuedomonasaeruginosa* and four genera of fungi; *Aspergillusniger*, *Aspergillusflavus*, *Penicillium* spp., and *Saccharomyces cerevisiae* were isolated. The susceptibility of these isolates to Epsom salt was determined using the agar diffusion method. *Klebsiellapneumoniae* and *Staphylococcus aureus* were highly sensitive to Epsom salt while the fungal isolates were unaffected suggesting that the salt has no antifungal effects.
Keywords: Epsom salt, Sewage, Sewage treatment, Susceptibility.

INTRODUCTION

The origin, composition and quantity of wastes are related to existing life patterns. When waste matter enters water, the resulting product is called sewage or waste water. Sewage is any liquid that has been severely or adversely affected in quality by anthropogenic influence (Tchobanoglous and Dowes, 2003). Sewage is correctly the subset of waste water that is contaminated with faeces or urine but is often used to mean any waste water. It can also be the liquid from toilets, baths, shower, kitchen, sinks e.t.c., disposed via sewers and some surface water from roof tops or hard standing areas (Kadam *et al.*, 2008).

The organic matter in a typical domestic sewage is approximately 50% carbohydrate, 40% protein and 10% fat. The pH range is from 6.5 to 8.0 (Karadi and Huang, 2008). The composition of sewage varies widely and it includes; water (> 90 %) which is often added during washing away or flushing to carry waste (liquid or solid) down a drain (Okoh *et al.*,

2007). Non- pathogenic (> 100,000/ ml for sewage) and pathogenic microorganisms such as bacteria, viruses, fungi, prions and parasitic worms are also present (Stensel *et al.,* 2003).

Harmful organic and inorganic compounds and pathogenic microbes in sewage can contaminate water causing water related diseases transmitted through fecal-oral route. These health problems include; bacillary dysentery, cholera, typhoid fever and acute gastrointestinal tract illness amongst others (Straub and Chandle, 2003; Hamner *et al.,* 2006; Oliver, 2010).

Epsom salt is the common name for a colorless or white crystalline salt magnesium sulphate hepta-hydrate, ($MgSO_4.7H_2O$) found in the minerals kieserite and epsomite, occurring dissolved in sea water and in most mineral waters. It was discovered in 1618 and it was first prepared at Epsom, England, where it got its name from. There it was distilled and marketed primarily as a bath salt (Milton *et al.,* 1999). The salt has a bitter taste, prepared from hydrated magnesium sulphate and formed by reacting magnesium salt and sodium hydroxide. The knowledge of it and its many uses have been with us since the 1500s.

In medicine, Epsom salt is used in treating patients with various illnesses ranging from cardiac arrest, respiratory congestion, fibromyalgia and osteoporosis. It is administered to delay or prolong the labor in women who are experiencing it prematurely; it flushes out toxins in the body that are brought about by stress and relaxes the muscles and soothes away pain (Arkin, 2008). Epsom salt is used in beauty treatments, soaps and detergents, food industry, pharmaceutical industry, agricultural industry and as an emulsion breaker in sewage clarification (Stentor, 2001).

This study therefore aims at determining the effects of Epsom salton microorganisms isolated from sewage with a view to ascertain its usage as a tool for sewage treatment before dispersal.

METHODOLOGY

Collection of Sample

Crude sewage samples were collected from two locations (Hostel I and Hostel II and labeled Sample A and Sample B respectively) in sterile containers at female hostels of a Nigerian University. These samples were immediately taken to the laboratory for microbial analysis.

Microscopy and Culture of Sample

1.0 ml of the stock solution of sewage sample A and B were serially diluted for up to 10^{-5} and 1.0 ml of the dilution samples was inoculated separately in duplicate plates of nutrient agar and potato dextrose agar using the pour plate method. All media were prepared according to manufacturer's instruction. The nutrient agar plates were incubated at 37^oC for 24 H while the potato dextrose agar plates were incubated at room temperature (28 ± 2^oC) for 5 – 7 days. Pure isolates of resulting growths were identified using the Bergey's Manual of Determinative Bacteriology (Holt *et al*., 1994) and Cowan and Steel's Manual for the identification of Medical bacteria (Barrow and Feltham, 1999).

The fungal isolates were examined macroscopically and microscopically following staining with lactophenol cotton blue wet mount technique (Cheesbrough 2006).

Test Organisms

The isolated bacteria and fungi from the sewage samples were used as test organisms. The isolates include: *Staphylococcus aureus, Escherichia coli, Klebsiellapneumoniae* and *Pseudomonas aeruginosa* for bacteria; while *Aspergillusniger, Aspergillusflavus, Penicillium* spp. and *Saccharomyces cerevisiae* for fungi. Pure cultures of these test organisms were used to determine the mean zones of inhibition of the Epsom salt used.

Determination of the Antimicrobial Activity of Epsom salt

The antimicrobial activity of Epsom salt was determined using agar well diffusion method (Cheesbrough, 2006). Following dilution in sterile distilled water, different concentrations of the Epsom salt solution were obtained as; 25 g/ml, 8.3 g/ml, 5 g/ml and 2 g/ml with sterile distilled water used as control.

In-vitro Demonstration of Antimicrobial Activity (Sensitivity Test)

After solidification of nutrient agar and potato dextrose agar, 1.0 ml of the different isolates already prepared in accordance to MacFarland standard were seeded evenly unto the surface of the nutrient agar and potato dextrose agar plates and a sterile glass spreader was used for even distribution of the in ocula. Holes or wells were drilled in the agar using a sterile cork borer of 6mm diameter and 1.0 ml of the Epsom salt solution at the different concentrations was introduced into the separate wells, with the central well containing sterile water, which served as the control. The Epsom salt solutions were allowed to diffuse into the medium and then incubated aerobically for 48 H at 37^{o}C for bacteria and at 28 ± 2^{o}C for fungi. The plates were examined for zones of inhibition which indicated the degree of susceptibility of the isolates. The minimum inhibitory concentration (MIC) defined as the lowest concentration that completely inhibited the growth showing a clear zone was also determined (Thongson *et al.,* 2004).

RESULTS AND DISCUSSION

From the investigation on the effects of Epsom salt on microorganisms isolated from sewage, the following results were obtained:

The mean population counts of bacteria and fungi isolated from the sewage samples A and B were 6.20×10^4 and 7.50×10^4 respectively for bacteria and 1.15×10^4 and 4.85×10^4 respectively for fungi (Table 1). This finding shows that the sewage samples contain a higher total viable count of bacteria than fungi. Sewage samples from Hostel II had a higher total viable count for both bacteria and fungi than that from Hostel I (Sewage sample A).

Table 1: Mean population counts of bacteria and fungi isolated from the sewage samples

Sewage Samples	Bacteria Count×104 (CFU / ml)	Fungal Count×104 (CFU / ml)
Hostel I (A)	6.20	1.15
Hostel II (B)	7.50	4.85

A total of eight (08) distinct microorganisms were isolated from the both sewage samples. Four (04) of the microbial isolates were bacteria while the other four (04) were fungi (Table 2).

Table 2: Microorganisms isolated from the sewage samples

Bacteria	Fungi
Staphylococcus aureus	*Aspergillusniger*
Klebsiellapneumoniae	*Aspergillusflavus*
Psuedomonasaeruginosa	*Penicillium spp.*
Escherichia coli	*Saccharomyces cerevisiae*

The Epsom salt solutions showed antibacterial activity with respect to the different concentrations used (Table 3). At concentrations of 25 g/ ml, 8.3 g/ml and 5 g/ml all the bacterial isolates showed clear zones of inhibition to the Epsom salt solution used. At the least concentration of 2 g/ml, only *Klebsiellapneumonia*e showed a clear zone of inhibition with 8.00 mm in diameter.*K. pneumoniae* and *S. aureus* were highly sensitive to the Epsom salt solution used.

The effect of Epsom salt were felt on the bacterial isolates at different concentrations but the fungal isolates showed no zone of inhibition to Epsom salt. The reason why the fungal isolates showed no sensitivity to the different concentrations of Epsom salt could be that the sewage fungi possessed some resistant structures in the form of spores, with which they used to withstand adverse conditions, in this case, as it has to do with the action of the Epsom salt on the biosynthesis of their cell wall components (Zhang *et al.*, 2003).

Table 3: *In – vitro* antimicrobial activity of different concentrations of Epsom salt solution using agar well diffusion method

Test Organisms	25 g/ml	Epsom Salt 8.3 g/ml	Solution 5 g/ml	2 g/ml	Distilled water (Control)
Bacteria	mm	Mm	mm	mm	mm
Staphylococcusaureus	13.00	12.00	11.00	0.00	0.00
Klebsiellapneumoniaes	13.20	11.60	0.40	8.00	0.00
Pseudomonasaeruginosa	11.00	10.00	9.00	0.00	0.00
Escherichiacoli	11.20	10.00	8.00	0.00	0.00
Fungi					
Aspergillus niger	0.00	0.00	0.00	0.00	0.00
Aspergillus flavus	0.00	0.00	0.00	0.00	0.00
Penicillium spp.	0.00	0.00	0.00	0.00	0.00
Saccharomycescerevisiae	0.00	0.00	0.00	0.00	0.00

*Values are mean zones of inhibition (mm diameter)

CONCLUSION AND RECOMMENDATION

Epsom salt is widely applied in general usage and as an emulsion breaker in sewage clarification. Thus, the results of this study have provided scientific justification for the use of Epsom salt in the inhibition of sewage microorganisms which constitutes health hazards if not properly treated or disposed. Therefore, the use of Epsom salt as an inhibitor of microorganisms especially bacteria, should be encouraged.

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