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"EVALUATION OF SOME SALTS OF HEAVY METALS AS
DISINFECTANTS"

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INTRODUCTION

Copper sulphate [1%] was used for treatment of phosphorous burns and have a fungicidal as well as bactericidal action Daniel [1973]. He also noted that, zinc oxide and peroxide have a disinfectant activity. Copper and zinc salts have been used since a long time in human and veterinary medicine Gemieux et al[1982]. Magnesium, copper and zinc salts are used in internal medicine and also externally; as purgative, collyric, burns treatment, ointments, lotions and in cosmetics.

The germicidal activity of these substances [Magnesium sulphate, magnesium chloride, copper sulphate and zinc oxide] were tested against salmonella typhi and staphylococcus aureus in absence as well as in presence of organic matter.

Experimental

Material and Methods:

The aim of this work is to test the bactericidal action of magnesium sulphate, magnesium chloride, copper sulphate and zinc oxide, as well as phenol against salmonella Typhi and staphylococcus aureus in absence and in

Presence of organic matter represented by sterile dried yeast.

The tested organisms were obtained from Egyptian organization for production of biological and vaccine products, Agouza, Egypt.

24 hours broth culture were used for running the tests as follows:

0.5 ml of 24 hours nutrient broth culture from each of the test organisms was added with sterile pipette to each one of the two sterile Petri dishes the culture was spread with sterile loop all over the surface of the petri dish [10cm in diameter] 0.5 gm of sterilized dried yeast was added to one of the contaminated petri dishes and heavily covered with the diluted salts to be tested.

A heavy loopful from the treated surfaces was seeded on a plate of nutrient agar at the intervals of 5, 10, 20, 30, 60 and 90 minutes, 2, 3, 6, 9, 12 and 24 hours after application.

The inoculated agar plates were incubated at 37 C for 24 hours; The exposure at which the microorganism died was recorded from the first subculture agar plate which showed no specific growth.

Results are recorded in table [1].

Table [1] . The time needed for killing sal. typhi and staph aureus by salts of heavy metals in absence as well as in presence of organic matter.

Addition of organic matter	Tested substance	Phenol 1%	Mag. sulphate 3%	Mag. chloride 6%	Copper sulphate 1.5%	Zinc oxide 3%
Without organic matter	Salmonella typhi	10 min	60 min	90 min	20 min	30 min
	Staph. aureus	20 min	2 hours	3 hours	60 min.	90 min
with organic matter	Salmonella typhi	60 min.	9 hrs.	12 hrs.	3 hrs.	6 hrs.
	Staph aureus	90 min.	12 hrs.	24 hrs.	6 hrs.	9 hrs.

Results and Discussion

The activity of some heavy metals salts and phenol was determined against salmonella typhi and staphylococcus aureus. The time needed for killing each organism in absence as well as in presence of organic matter are recorded in Table [1]. In absence of organic matter; Phenol [1%] took 10 min and 20 min. for killing salmonella typhi and staph. aureus respectively; Magnesium sulphate [3%] destroyed both organisms after 60 minutes and 2 hr. respectively. The time needed for killing Sal. typhi and staph. aureus were 90 min. and 3 hrs. respectively by magnesium chloride [6%]. while on using copper sulphate [1.5%], sal- typhi and Staph. aureus were killed within 20 and 60 min. respectively. Regarding Sal. typhi and staph. aureus; respectively.

These results indicated that, all tested substances needed a time of 10 min. to 3 hrs. to exterminate the two tested organisms in absence of organic matter of which the phenol showed the shortest 10 min. followed by copper sulphate min., and the magnesium chloride took the longest time 3 hrs.

Copper sulphate was tested against sal typhi [dil 1/4] and staph. aureus [dil. 1/5], and it was lethal in 10 minutes [Sprowls & poe, 1943 a].

The salts of heavy metals are more toxic than those of lighter metals. In pure solution all salts of heavy metals are germicidal to some extent except in very low concentration [Topley and wilson, 1975]. Cations working with E. coli, Winslow and Hotchkiss [1922] arranged the cations in order of increasing toxicity as follows: K, Na, NH₄, Li, Sr, Ni, Zn, Cu, Fe, Co. Pb, Al, Ce, Cd, Hg.

While in the presence of organic matter, the time taken for killing Sol. typhi and Staph aureus by phenol [1%] were 60 and min.; Mag. sulphate [3%] were 9 and 12 hrs.; Mag. chloride [6%] were 12 and 24 hrs., Copper sulphate [1.5%] were 2 and 6 hrs; zinc oxide [3%] were 6 and 9 hrs. respectively.

These results indicated that the tested heavy metal's salts killed the two organisms within a range from 60 min to 24 hrs. in presence of organic matter of which copper sulphate [1.5%] showed the shortest time 3 hrs., while mag. chloride needed the longest time 24 hrs.

The presence of organic matter decreased the bactericidal activity of the used substances. Of these chemical substances copper sulphate was found to be the least affected by organic matter while magnesium chloride was greatly affected; these results are agreed with those greatly affected these results are agreed with those obtained by McCulloch et al [1948], Beam [1967], Ismail [1967], Marzouk [1977] and eye drops may increase their antiseptic action, which agree with Daniel [1973] and Cremieux et al [1982]. The uses of the heavy metal's salts in practice is safe because they are not toxic due to their emetic action but may be irritant and sometimes allergic Schorr [1970]. Although it was suggested that copper salts be used to disinfect water much as chlorine is now used [McCulloch, 1945].

In case of practical application of these compounds in veterinary or medical practice, it is advisable to wash wounds, burns and infected lesions with a cleaning mild agent for removal of any organic discharges and exudates to achieve an efficient antiseptic function of the used already tested materials.

SUMMARY

The germicidal activity of magnesium sulphate [3%], magnesium chloride [6%], copper sulphate [1.5%], zinc oxide [3%] and phenol [1%] were tested against *Salmonella typhi* and *Staph. aureus* in absence as well as in presence of organic matter.

The tested substances needed a time of 10 min. to 3 hrs. to exterminate the two organisms in absence of organic matter, of which the phenol showed the shortest 10 min., followed by copper sulphate 20 min., and magnesium chloride took the longest time 3 hrs.

The presence of organic matter decreased the bactericidal activity of the used substances. Copper sulphate was found to be the least affected by organic matter while magnesium chloride was greatly affected.

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ملخص البحث

تقييم بعض أملاح الفلزات الثقيلة كمطهرات

تم دراسة كفاءة بعض أملاح الفلزات الثقيلة كمطهرات وكذلك الفينول في التركيزات الآتية فينول ٠/٠١ ، كبريتات الماغنسيوم ٠/٠٣ ، كلوريد الماغنسيوم ٠/٠٦ ، كبريتات النحاس ٠/٠١٠٥ ، وأوكسيد الزنك ٠/٠٣ لآبادة بعض الميكروبات المرضية وهي السالمونيلا تيفي والميكروب العتقودي الذهبي في وجود وعدم وجود المواد العضوية وقد وجد أن الوقت اللازم لآبادة الميكروبين قى عدم وجود المواد العضوية هو ١٠ دقائق إلى ٣ ساعات ويحتاج الفينول أقل وقت ١٠ دقائق ثم كبريتات النحاس ٢٠ دقيقة ويأخذ كلوريد الماغنسيوم أطول وقت .

أما في وجود المواد العضوية فنجد أن كفاءة هذه المواد تقل وأن كبريتات النحاس أقلهم تأثراً وكلوريد الماغنسيوم أكثرهم . ولذلك فأن وجود المواد العضوية يثبط من كفاءة وقـدرة أملاح الفلزات الثقيلة المستخدمة .