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**STUDY ON THE BACTERIOCIDAL EFFETIVENESE OF SOME
DISINFECTANTS AND THE BIOLOGICAL VALUE OF FEEDLOT
WASTES AND POULTRY LITTER AFTER BEING APPLIED
(Wit 3 Tables)**

By

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دراسة فعالية بعض المطهرات وتأثيرها على المركبات النيتروجينية
في الارضية الترابية للحيوانات والفرشة العتيقة للدواجن
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تم في هذا البحث دراسة فعالية الجير الحي والمطفي، ومسحوق ازالة الألوان والفورمالين والسوبر فوسفات على بقاء ميكروبات السالمونيلا والاشريشياكولي والكورابني القلبي والمكسورات العنقودية الذهبية في الأرضية الترابية التي تحتوى على روث الابقار والاغنام وكذلك الفرشة العتيقة للدواجن وكذلك تأثير هذه المطهرات على المركبات النيتروجينية والاس الهيدروجيني لها لتقييم مدى ملائمتها في تخصيب التربة في مصر لما لذلك من أهمية اقتصادية بالإضافة الى النواحي الصحية البيئية. وأوضحت النتائج أنه بالرغم من الفعالية الجيدة للجير الحي، المطفي، كمطهر إلا إنها تجعل من هذه المخلفات غير ملائمة لتخصيب التربة حيث أنها تزيد من قلويتها وكذلك تقلل من نسبة المركبات النيتروجينية بها. كذلك وجد أن مسحوق ازالة الألوان يحدث نفس التأثير بالإضافة الى ضعف فاعلية كمطهر نتيجة وجود المواد العضوية. وقد أوضحت النتائج أفضلية استعمال الفورمالين 4% كمطهر قوى بالإضافة الى عدم تأثير نسبة المركبات النيتروجينية والاس الهيدروجيني مما يتيح الاستفادة من هذه المخلفات كمخصبات للتربة المصرية ويوصي باستعمال الفورمالين 4% مضافا اليه السوبرفوسفات لزيادة فعاليتها كمطهر ومقدرته على ازالة الروائح وزيادة الحموضة مما يزيد من قيمتها في تخصيب التربة. ولهذا البحث أهمية اقتصادية بالإضافة الى الأهمية الصحية للمحافظة على سلامة البيئة من التلوث.

SUMMARY

The study dealt with the effectiveness of lime, chlorinated lime, formalin and superphosphate compound applied to cattle and sheep wastes combined with bedding and to poultry litter experimentally contaminated with Salmonella typhimurium, E.coli, corynbacterium pyogenes and Staphylococcus aureus. Moreover, the study investigate the effect of disinfectants used on the behaviour of some nitrogen compounds in the feedlot wastes and poultry litter.

Experimental results revealed that the bacteriocidal effectiveness of disinfectants used ranked in increasing order of exposure time as: Quick lime, saked lime, formalin, bleaching and superphosphate. Evaluation of wastes after disinfection revealed that lime and chlorinated lime decreased the contents of several nitrogen forms in animal and poultry

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A.H. HAFEZ, *et al.*

wastes as well as increased its alkalinity which decreased its value for utilization on to lands and can be a problem in some crops. In contrast, formalin 4% as well as superphosphate increases in nitrogen contents of the wastes and pH ranged from neutral to acidic respectively and therefore such management could be more suitable to Egyptian soils.

INTRODUCTION

Most infected animals or birds eliminate the pathogenic agents by way of urine, faeces or droppings so that germs ultimately come into contact with the floor of the buildings. Utilization of unprocessed feedlot wastes presents problems of zoonosis, aesthetic problems and pathogen viability (TAYLOR, 1971). Disinfection is an important part of controlling disease agents, high standards of sanitation, utilization of waste products and to protect the quality of the environment. Preferred disinfectants are the effective, inexpensive and also safety render the waste mixture for subsequent agriculture purposes.

For conventional inside disinfection, DYKSTRA (1961) showed that formaldehyde solution in 4% strength is effective against all germs. He also showed that the dry powder of chlorinated lime may be sprinkled lightly on stable manure and decaying animal and vegetable matters and should be repeated frequently. GRINITINA (1964) found that suspension of bleaching powder containing 2% active chlorine at the rate of 1 L per m² surface area for 24 hours was found to be effective in disinfecting farm yards. KRASNOSHCHEROV (1962) reported that quick lime scattered as a dry powder of freshly slaked (20%) in water was considered as a good disinfectant on manure and other animal discharges that killed microorganisms within 5 minutes. ISMAIL (1967) showed that formalin (36%) in the dilution 1:30 killed *Salmonella typhimurium*, *E. coli* and *Staph. aureus* in experimentally contaminated dirty soil within 30 minutes exposure time while milk of lime (1:4) killed them within 10 minutes. He also reported that suspension of bleaching powder in water containing 0.06% active chlorine killed *Salmonella typhimurium* and *E. coli* after 20 minutes but *Staph. aureus* after 1 h. exposure.

On the other hand, DYKSTRA (1961) showed that when superphosphate compound was added from time to time to manure accumulations, it serves as a deodorant and fix ammonia nitrogen so as prevent its escape and thus leaves the manure as a more valuable fertilizer. He stated that litter used in poultry houses are placed on the floor to a depth of six inches and mixed with hydrated lime or superphosphate at a rate 25 pounds for each 400 square feet of floor space. Moreover, YOVCHEV (1974) revealed that *Salmonella abortus ovis* could not be recovered from soiled litter of a lambing pen after treatment with bleaching powder 200 g/m² plus 20% solution of calcium superphosphate of 500 ml/m² after 8 h. exposure time.

PRATT (1979) noted that physical and biological management restrictions on the use of manure on lands include pathogen transmission; crop quality; water and soil quality. And as management systems change, field research with the manure produced is needed to assess N availability. Manure treated with disinfectants is controlled by its effect on nutrients availability in addition to its nitrogen content.

EVALUATION OF DISINFECTANTS

The objective of this study was to evaluate the effectiveness of some disinfectants applied to feedlot wastes and poultry litter experimentally contaminated with *S.typhimurium*, *E.coli* coryn. pyogenes and *Staph. aureus* as well as its biological value after disinfectants being applied. Moreover, the question is raised as to determine the bacteriocidal effectiveness of superphosphate compound in addition to its biological value.

MATERIAL and METHODS

Bacteriocidal effectiveness :

In this trial 15 samples of dirty floor containing manure were collected from each of conventional units of cattle, sheep and poultry in the vicinity of Assiut. 30 g of each mixed sample of soil or litter were placed in 17 cm Ø Petridishes and all of it were sterilized by autoclaving. Strains of *Staphylococcus aureus*, *Escherichia coli*, *Salmonella typhimurium* and *Corynebacterium pyogenes* were used as test organisms for evaluating the bacteriocidal action of disinfectants. 5 Petridishes of each soil sample were contaminated with each of the liquid culture media of microorganisms in an equivalent volumes. The organisms were supplied from Dept. of Microbiology, Fac. of Med., Assiut University.

Testing was performed with 4% formalin (Containing 38% of formaldehyde gas), quick lime, fresh hydrated lime, chlorinated lime (containing 26% active chlorine) and commercial superphosphate compound applied at proportion of 0.5 g/15 cm² surface area of soil or litter. Effectiveness was determined from microbiological swabs after exposure time of 15, 30, 45, 60 minutes and then every hour up to 12 hours. Cultivation was carried out on MacCONKEY agar media for *Salmonella* and *E.coli*, while salt mannitol agar and tellurite blood agar media were used for *Staph.* and *Coryn. pyogenes* respectively (CRUICKSHANK *et al.*, 1980).

Biological value of feedlot wastes after disinfectants being applied :

Total nitrogen (T.N), ammonium nitrogen (NH₄) and nitrate nitrogen (No₃) were determined according to PAGE *et al.* (1982). Soil pH was measured using glass electrode (JACKSON, 1958).

RESULTS

It was clear from Table (1) that the most bacteriocidal action within a shorter exposure time was obtained by quick lime (30 min). Moreover, slaked lime killed *Staphylococcus aureus* in soiled wastes after 45 min. While 15-30 min. for the other strains of bacteria. Also 4% formalin killed *Salmonella typhimurium* and *Coryn. pyogenes* in wastes within one hour exposure time while *Staph. aureus* and *E.coli* killed within 4 and 2 hours respectively. Low effectiveness was revealed with chlorinated lime, and superphosphate (6-12 h.).

The data presented in Table (2 and 3) showed that :

1- Poultry litter containing droppings have highest total nitrogen content value compared with feedlot wastes of sheep and cattle. The latter revealed the lowest total nitrogen value.

2- No change total N% of the waste types was noticed when formalin or superphosphate were used compared with the control samples.

3- Superphosphate treatments gave a pronounced effect on keeping ammonia against loss. the highest value of NH_4 were revealed after superphosphate treatment over control and disinfectants.

4- Regarding to NO_3 % of treated samples, no specific trend could be detected after the application of different compounds.

DISCUSSION

Disinfection as part of sanitation procedures protect the quality of the environment and permits the utilization of feedlot wastes for subseuent agriculture purposes. It is well established that incidence of latent infections increases when animals of homogenous populations are concentrated in confinement. A number of epidemiological reports have attested that transmission of enteric disease can occur when untreated wastes are used in cultivated lands (YEAGER, 1980). From the economic point of view, the daily exretion of wastes ranges from 3.6% of total live weight for sheep, 4.6% for beef cattle, 6.6% for laying hens, to 9.4% for dairy cattle (TAIGANIDES, 1977). In the hight of the present facts, the protection of agricultural environment from pollution by means of animal wastes is an urgent matter.

Investigations on the efficieny of tested compounds for bacteriocidal action as well as the biological value of wastes after such compounds being applied explained the following:

1- Chlorinated lime quickly loses its effectiveness as disinfectant in the presence of organic matter which protect the germs (Table 1). Moreover, it lowered the nitrogen content of waste types as well as highly increased its alkalinity which make it unsuitable for further use in agriculture (Tables, 2 & 3).

2- Lime, whether quick lime or slaked lime, although it revealed a good bacteriocidal action (Table 1) and its lack of noticable odour, it lowered the biological value of wastes through higher alkalinity and noticable decrease in total nitrogen content (Tables 2 & 3). It could be concluded that lime treatment could be beneficial in acid soils of humid regions since pH value of Egyptian soils lies in the neutral to slightly alkaline range.

3- It was concluded from the study that formalin proved as a good disinfectant (Table 1) and also do not alter the total nitrogen content of wastes as well as its pH value (Tables 2 & 3). Moreover, superphosphate although it showed low bacteriocidal effectiveness, it could be added to formalin to lower pH and increase its biological value for agriculture purposes as well as a deodorant.

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EVALUATION OF DISINFECTANTS

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Table (1). Bacteriocidal exposure time of disinfectants applied on to feedlot wastes.

Disinfectants Test organisms	Quick lime		Slaked lime		Chlorinated lime		Formalin		Superphosphate					
	Ca.	Sh.	Po.	Ca.	Sh.	Po.	Ca.	Sh.	Po.	Ca.	Sh.	Po.		
Staph.aureus	15m	15m	30m	30m	30m	45m	10h	10h	12h	3h	3h	4h	12h	12h
S.typhimurium	15m	15m	15m	30m	30m	30m	6h	6h	6h	1h	1h	1h	6h	8h
E.coli	15m	15m	15m	30m	30m	30m	6h	6h	8h	2h	2h	2h	8h	8h
Coryn.pyogens	15m	15m	15m	15m	15m	15m	5h	5h	6h	1h	1h	1h	6h	8h

Ca. =Cattle, Sh.=Sheep ,Po.=Poultry h = hours, m = minutes

EVALUATION OF DISINFECTANTS

Table (2) : Nitrogenous compounds of feedlot wastes after treatments (on dry matter base).

Type of Manure	Poultry			Cattle			Sheep		
	TN%	NH ₄ %	NO ₃ %	TN%	NH ₄ %	NO ₃ %	TN%	NH ₄ %	NO ₃ %
<u>Disinfectants</u>									
1-Without (control)	3.93	0.161	1.43	1.62	0.064	0.110	2.18	0.129	0.193
2-Superphosphate	3.62	0.370	0.97	1.50	0.129	0.248	2.00	0.225	0.248
3-Chlorinated lime	2.81	0.113	0.97	1.25	0.097	0.138	1.62	0.113	0.386
4-Quick lime	2.93	0.129	1.50	1.12	0.097	0.055	1.62	0.081	0.469
5-Slaked lime	2.49	0.113	1.19	0.94	0.810	0.055	1.25	0.064	0.276
6-Formalin 4%	3.80	0.135	1.23	2.12	0.081	0.221	2.43	0.064	0.497

Table (3) : pH values of feedlot wastes after different treatments of disinfectants.

Disinfectants	Control	Super-phosphate	Chlorinated lime	Quick lime	Slaked lime	Formaline 4%
pH values	7.00	5.61	11.11	12.38	12.33	7.05