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Brief communication

Synthesis and Characterization of Fertilizer Grade Urea from Cattle Waste

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ABSTRACT

Nitrogen, Phosphorous and Potassium are the three major nutrients required for healthy plant growth. Cow urine contains significant amount of Nitrogen and Potassium. The recent research show that only 20% of nitrogenous material consumed by cattle is absorbed remaining 80% excreted in urine and dung. This study shows that the fertilizer grade urea synthesized from cow urine by standard procedure and characterized by FT-IR for functional group determination. The presence of urea in the sample was confirmed by Biuret test. This study gives a ample scope to the farmers to increases the soil fertility and better yield of agricultural products. The percentage of Carbon, Nitrogen, Oxygen and Hydrogen in synthesized urea was determined by the chemical analysis.

Keywords: FT-IR, Cow Urine, Nitrogen, Oxygen.

INTRODUCTION

The composition containing cow's excertions are urine, dung, milk, and the milk by products of curd and ghee are five substances collectively referred to as Panchagawya. It is given to women after she delivers a baby and also the primary components in ayurveda medicine[1]. Cow urine one of the fixing in Panchagawya is carried on to have therapeutic value. In India cow urine is utilized by larger part of rural population as a folklore remedy[2].

According to Ayurveda, gomutra is capable of curing diseases in filarial, cancer etc. Cow urine has been used to treat various diseases such as anemia, fever, cardiac arrest, asthma etc[3].

Plants are needed the macro nutrients of Nitrogen, Phosphorous and Potassium for their healthy growth, which obtained from soil through the fertilizers. The waste cow urine is one of the important source of nitrogenous fertilizer for plants growth.

In cattles approximately 52% nitrogen returns in the form of urine while 28% of return in

the form of dung. However, the recent research showed that the cow urine contains phenol, carbolic acid and aurum oxide which act as antifungal and antibiotics[4]. In fact-cow urine is used by the farmers as an effective indigenous method to control crop pests and spraying of the cow urine has been recommended to minimize the harmful effects of synthetic pesticides[5]. Moreover, the eco-friendly crop protection measures including application of the cow urine are desirable as there is increasing awareness of pollution free environment and preference for chemical free foods[6].

During the past two decades, there has been an eloquent role on the global area to look forwarding the healthy food. Currently organic farming played the conventional role for all over the world[7]. Cow urine is basically an excellent antimicrobial agent and act as disinfectant. Cow urine contains 95% H_2O, 2.5% urea and other minerals hormones and enzymes. In the operation of agriculture, cow urine promotes the usage of bio pesticides in impuring fertility of soil and effective as pest controller[8]. Therefore, the usage of cow urine provides better opinion to synthetic products (Chemicals) which are high cost and are environment[9]. The various research shows that the cow urine enhance the productivity of various crops such as rice, wheat etc[10].

Application of cow urine improves the characteristics of soil that influence the plant growth. It checks out the deficiency of micronutrients. In organic agriculture, bio enhancing is one of the property of cow urine. It increased the effectiveness of soil fertility and soil texture[11]. Vermi wash could extracted the source for soil fertility, production of crop, pest control etc[12]. Higher amount of phenols in fresh urine are more effective in antimicrobial activity. The photo activated cow urine promotes better antioxidant[13]. Presence of organic phosphorus, chloride may play a vital role during photoactivation in cow urine. It prevents the production of antibacterial resistance which gets blocked the R-factor. Antioxidant property of allanttois present in cow urine correspondence with its anticancer effect[14].

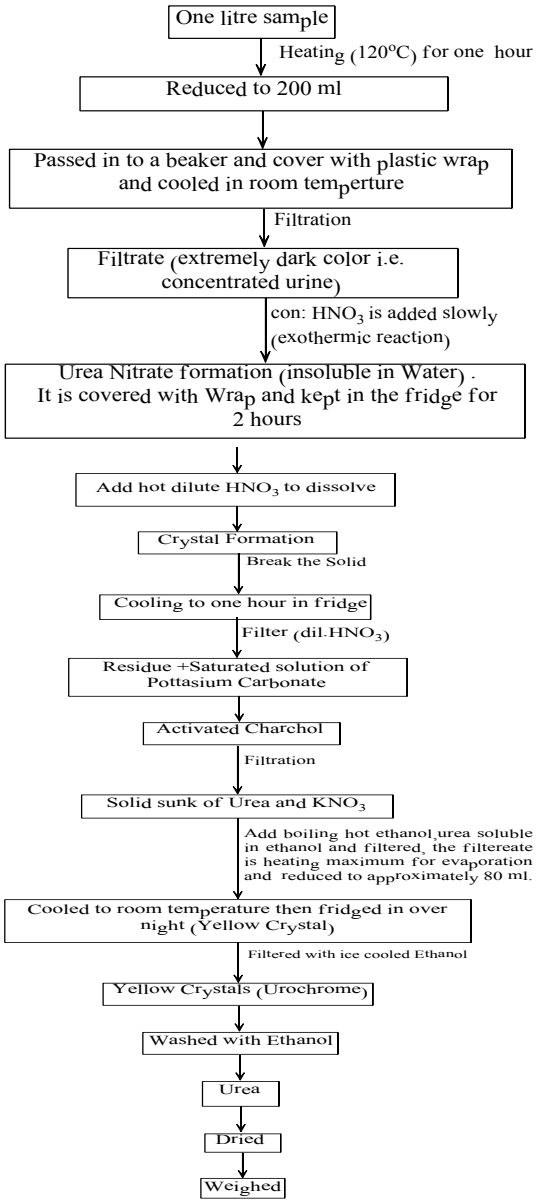
MATERIALS AND METHODS

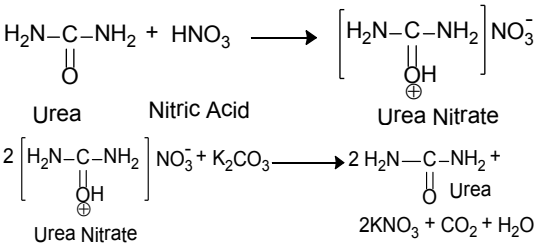
One litre of cow urine sample was collected and heated to 120^{0}C for one hour which is reduced to 200 ml due to the loss of water molecules. The sample was poured in to a 500 ml beaker and cover with a plastic wrap and waited to cooled in to a room temperature. The cooled sample was filtered using Whatman 40 filter paper and the filtrate of extremely dark colour concentrated urine was collected in a 500 ml beaker. The sample was digested with concentrated nitric acid using a glass rod and stirred well. During this reaction urea nitrate crystals was formed. This reaction was highly exothermic and the formed brown colour solid of urea nitrate crystals which is insoluble in water. The beaker was covered with wrap and kept in to the fridge for 2 hours. The urea nitrate crystals are broken by glass rod. The mixture was filtered and the filtrate was discarded. The residue obtained from the filtration added to hot dilute nitric acid to dissolve by using magnetic stirrer. This is kept for room temperature without any disturbance.

The formed crystals were kept in fridge for an hour and the sample was filtered with the help of ice cooled dilute nitric acid. The residue mixed with saturated solution of potassium carbonate slowly, all the solid urea nitrate crystals are dissolved and the clear solution is obtained. The K_2CO_3 is added until the clear solution obtained. The above sample, 0.5 g of activated charchol was added and thoroughly mixed. The sample was filtered again, the dark colour filtrate was heated in hot water bath up to boiling. The sample was kept for few minutes, the solid sunk of urea and KNO_3 was formed.

The above mixture is heated to boiling with hot ethanol, the urea in the sample was dissolve and collected through the filtration, which was further reduced to 80 mL by evaporation. It was cooled to room temperature then kept in fridge to overnight. The yellow crystals of urochrome was obtained which was washed by water and ethanol mixture. Finally the solid urea sample was collected and again washed in ice cooled ethanol. The collected sample was dried and weighed accurately[15].

Flow Chart for the synthesis of Urea from cattle waste





The synthesized urea from cattle waste was subjected to FT-IR(Science Instrumentation Centre –Ayya Nadar Janaki Ammal College (Autonomous), Sivakasi, Tamil Nadu, India) for functional group determination and the percentage of Carbon, Nitrogen, Oxygen and Hydrogen in urea was found by chemical analysis. The presence of urea in the sample was confirmed by Biuret test. (Test for diamide).

Biuret test

The urea sample taken in a dry test tube and added the 1 mL of Copper Sulphate Solution followed by 1 mL of Sodium Hydroxide solution. The solution is shake well and let it stand for five minutes. The appearance of Violet colour is confirmed that presence of urea in the synthesized sample.

RESULTS AND DISCUSSION

The yield of urea obtained from the process are 2.126 g. The standard FT-IR data for urea has C-N stretch 1650 cm^{-1}, C=O stretch 1650-1800 cm^{-1} and the N-H stretch has 3350-3500 cm^{-1}.

This present study shows that the spectral peaks of FT-IR for synthesized urea has N-H stretch band is 3355 cm^{-1}, C=O stretch band is 1659 cm^{-1} and 1597 cm^{-1} for C-N stretch. The other spectral peaks in images are due to the presence of foreign materials in urine sample. This is confirmed that the synthesized sample was urea. The strong peak at 1386 cm^{-1} has C-H bending which is not the functional group of urea but it has revealed that the urine sample contains excess organic carbon.

The mass percentage of carbon is 24.32, Nitrogen is 40.63, Oxygen is 21.07 and Hydrogen has 4.76. The overall purity of synthesized urea has 90.78 percentage which is good for fertilizer grade and remaining 9.22 percentage of foreign substances (impurities). The higher percentage of carbon in the sample may be due to the nature of cattle feed and age of the animal. The biuret test confirmed that the synthesized compound was urea.

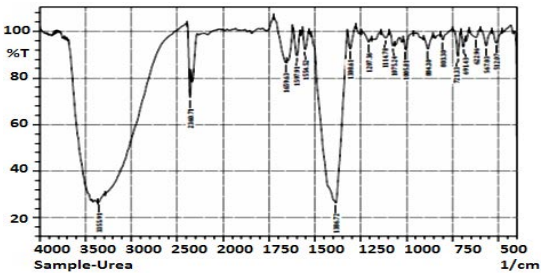


Fig. 1. FT-IR Spectral data

Table 1: Elemental composition of synthesized urea

No	Element	Percentage(%)	Purity(%)
1	C	24.32	90.78
2	N	40.63	
3	O	21.07	
4	H	4.76	

Table 2: Elemental composition of standard value of Urea

No	Element	Percentage(%)	Purity(%)
1	C	20.01	100
2	N	46.66	
3	O	26.67	
4	H	6.67	

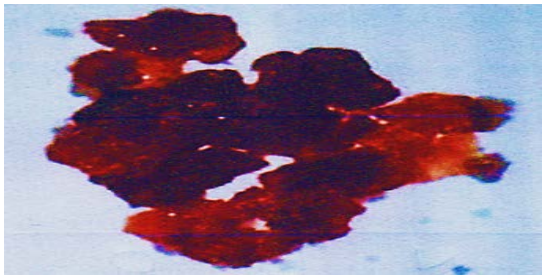


Fig. 2. Synthesized urea sample

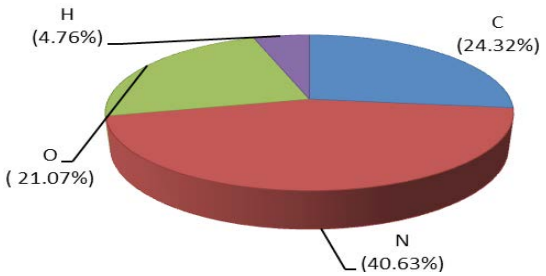


Fig. 3. Pie diagram of elemental composition of synthesized urea

CONCLUSION

The synethsized urea from the cattle waste was economically possible and its increasing the additional income to the farmers and upgrade the soil fertility as similar to the industrial grade urea. By industry, urea prepared from the reaction between Carbon dioxide and ammonia.

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15. https:// nile.red extracting urea from my own pee.