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PREPARATION OF FERTILISER FROM HUMAN URINE

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Abstract: Human urine is rich valuable plant nutrients and when separately collected, it can substituted for fertilizers. Organically agriculture products are gaining popularities throughout the world as it gives consumers satisfaction with a basket of safer and trusted foods. However organic agriculture practices give an alternative environmental friendly sustainable agriculture among the farmers. Besides this fact organic crops contain fewer nitrates, nitrites, pesticides residues and trace elements that conventional crops. Even through, in organic system generally have 20% lower yield than conventionally produced crops. Therefore ongoing research are looking forward for different organic sources which are plenty in nature available at a little-to-no cost.

"Human urine" is one of them, and has been gaining popularities as a raw material for organic cultivation. In this study STRUVITE produced from human urine which can be applied to fields just like any other fertilizer. To happened this process built a reactor (struvite reactor),and collected urine placed in reactor then add Magnesium sulphate($MgSO_4$), mixture will be stirrer for 10 minutes, then Filtrate it.Dried it for 2 days at room temperature. At the last struvite crystal powder obtained.

Key words: Struvite , preparation of chemicals, collection of fertilizer

1. INRODUCTION

Graphene Human urine is the most common waste water.In various part's of the world where there is human habitat , they are involved for generating waste and one of them is urine.But urine can be used as source to generate struvite.In human bodies, after the blood filtration in the kidneys urine is produced, but there is no filtration of proteins , so it has a low molecular weight compounds. Urine plays an important role in the earth's nitrogen cycle.In balance eco-system, urine fertilizers the soil and thus helps plants to grow.The daily volume and composition of urine varies per person based on the amount of physics exertion , environmental condition as well as water ,salt and protein intakes.

1.1 General characteristics of human urine:-

Quantity

Average urine produced in human is 1.4Liter of urine per person per day with a normal range of 0.6 to 2.6 L per person per day.

Constituents

About 91-96% of urine consist of water. The remainder can be characterized into inorganic salts, urea, and organic compounds. The total solids in urine are on the average 59 g per person per day. Organic matter makes up between 65% and 85% of urine dry solids, with volatile solids comprising 75–85% of total solids. Urea is that the largest constituent of the solids, constituting quite 50% of the entire.

Fig1.1 Urine image under microscope.

1.2 Typical design values for the concentrations of constituents in fresh urine:-

Parameter	Value
pH	6.2
Total nitrogen	8830 mg/L
Ammonium/ammonia-N	460 mg/L
Nitrate and nitrite	0.06 mg/L
Chemical oxygen demand	6000 mg/L
Total phosphorus	800 - 2000 mg/L
Potassium	2740 mg/L
Sulphate	1500 mg/L
Sodium	3450 mg/L
Magnesium	120 mg/L
Chloride	4970 mg/L
Calcium	230 mg/L

Color:-

Urine varies in appearance, depending principally upon a body's level of hydration, also as other factors. Normal urine may be a transparent solution starting from colorless to amber but is typically a straw . In the urine of a healthy individual, the colour comes primarily from the presence of urobilin. Urobilin is a final waste product resulting from the breakdown of heme from hemoglobin during the destruction of aging blood cells.

Figure 1. Dark yellow urine due to low fluid intake.

Figure 2. Dark red urine due to blood

Figure 3. Pink is urine due to consumption of beet roots.

Figure 4. Green urine

Odor :

Urine smell 'fish like 'odor because of contamination with bacteria that break down urea into ammonia. This odor is not present in fresh urine of healthy individuals; its presence may be a sign of a urinary tract infection. Eating asparagus can cause a strong odor reminiscent of the vegetables caused by the body's breakdown of asparagusic acid.

PH:

Urine PH normally is within the range of 5.5 to 7.in persons with hyperuricosuria, acidic urine can contribute to the formation of stones of uric acid in the kidneys.

Density:

Human urine has a specific gravity of 1.003-1.035.

Uses:

1. Source of medications.

Urine contains proteins & other substance that are useful for medical therapy & are ingredients in many prescription drugs like ureacin , urecholine.

Urine from postmenopausal women is rich in gonadotropins that can yield follicle stimulating hormone & luteinizing hormone for fertility therapy.

Urine can also be used to produce urokinase which is used clinically as a thrombolytic agent.

2. LITRETURE REVIEW

In 2020 Prithvi simha, Bjorn vinneras, Jenna seneca found a way to turn Human urine into solid fertilizer. And that could make farming more sustainable.They discovered that increasing the PH of urine to make it alkaline ensures the urea doesn't break down or end up smelling really bad.Using this technique, they developed a process that can reduce the volume of urine and transform it into a solid fertilizer and this technique called as Alkaline urine dehydration.

In 2016berkely engineering graduate student William tarpeh built a device that efficiently extract nitrogen from Human urine. Then this nitrogen is used to create a nutrient rich , affordable fertilizer , which farmers in the developing world can use to produce more crops.

In the year 2016Shanta Dutta and Bjorn vinneras explored the possibility of making fertilizer at a laboratory from source separated and untreated human urine added to ash and lime by drying at low temperatures. A mixture of ash and lime (1:1) was used as drying agent and human urine was applied as undiluted and fresh. Ash and lime were chosen as drying agents for maintaining a pH >10 during the drying process, which should inhibit urea hydrolysis in urine, and thereby urea should be retained in the drying agent. The drying technique was developed and drying capacity of the system was quantified; three specific temperatures (20 W, 35 W, and 60 WC) and two airflow rates (1 L/min and 5 L/min) were used in the experiment.

In a year 2017 J. Nagy and A. Zseni done a research on urine contains most of the nutrients of human excreta, researches focus mainly on urine's treatment and utilization for agricultural purposes. We reviewed the data in literature about the nutrient content of human excreta. In this paper we present the content of macro and microelements of human urine to show its potential value as a fertilizer. To confirm the necessity of urine's utilization in agriculture instead of treated it by traditional waste water treatment methods, we have collected and compared the most important advantages and disadvantages of traditional wastewater treatment, separated handling of greywater and excreta as well as human urine's agricultural utilization.

3. EXPERIMANTEL SECTION

RAW MATERIAL: As in figure shows a urine contain bottle has been collected from my own self. Along with in image 3.2 magnesium sulphate shown.

3.1 Collected urine sample.

3.2 Magnesium Sulphate (Mgso 4).

METHOD:

Struvite:

Through a basic precipitation reaction, the majority of phosphorus in urine can be crystallised into a white, odourless powder: struvite ($MgNH_4PO_4 \bullet 6H_2O$), sometimes also called
Magnesium Ammonia Phosphate Hexahydrate . Struvite is a bioavailable, slow-release fertiliser; it is compact and can be stored, transported and applied easily, and does not smell (see the picture below). Through struvite recovery, over 90% of phosphate can easily be removed from urine.

How I made a struvite reactor?

I built a struvite reactor at cheaper cost, using locally available materials and skills (see the figure below). The main tank are made up of Aluminum or galvanised steel sheets. The stirring mechanism, as well as the supporting structure should be assembled from steel, Pipes and fittings should be made of plastic to prevent corrosion. Valve is made up of brass and filter module made of plastic.

3.3 Struvite Reactor.

The reactor consists of a stirring mechanism, which is fitted inside the tank; a filter bag hangs below a valve to allow the main reactor to be drained (see the figure below). To start the process, the collected one litre urine and 2.3g magnesium sulphate are mixed for 10 minutes in the reaction tank one . The valve is opened and the suspension is then drained into the filter bag. The filter bag retains the struvite while the effluent passes through. The filter bag is air dried for one to two days, after which point the struvite is ready to use. Urine contains phosphate and ammonia. So when we add to urine, phosphate ,ammonium and magnesium bind and form struvite.

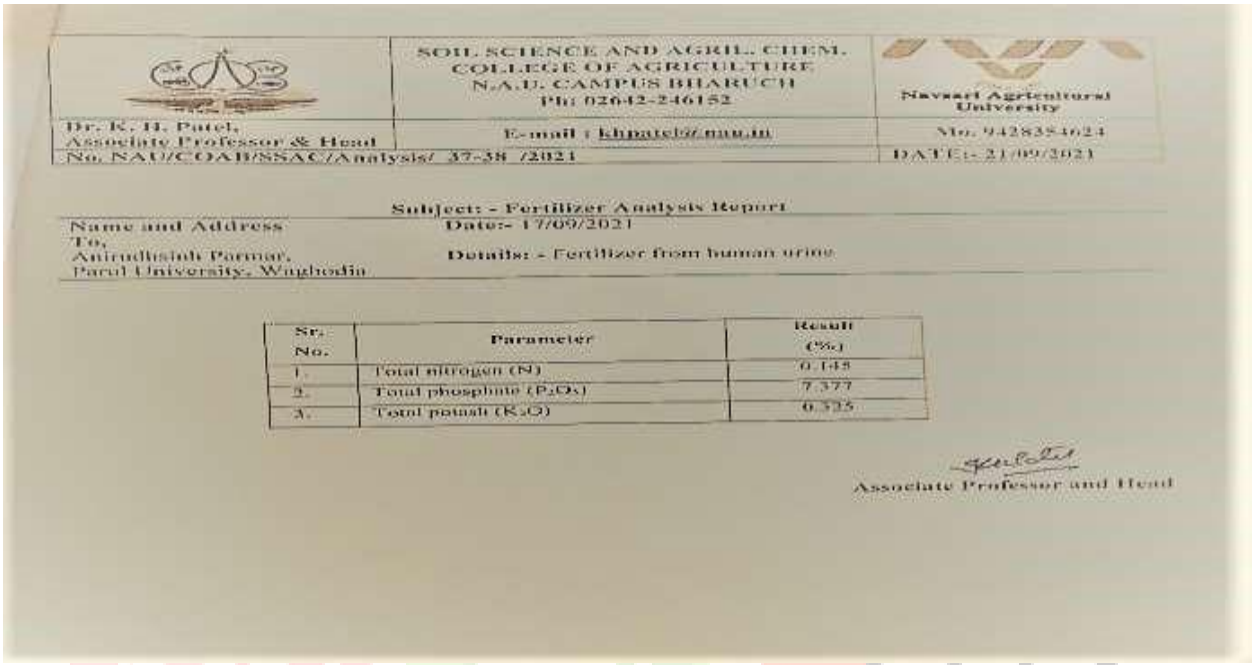
This type of reactor was able to recover over 90 % of the phosphate contained in the urine. Because struvite also precipitates naturally from urine, any precipitate in the collection system should be incorporated into the final product, in order to maximise nutrient recovery.

Figure 3.4 Struvite (NH4MgPO4.6H2O)

4. Result and Discussion

This type of reactor is able to recover 90% of the phosphate contained in the urine. Because in normal urine, the concentration of phosphate is subsequently the limited factor. The artificial addition of magnesium to urine is therefore a very convenient way of fixing the phosphorus and a part of the nitrogen that is contained in urine.

Further some test conducted of struvite to measured present value of nitrogen and phosphate and potash by using different methods of measurement which is Referred (Jackson ,M L.(1979).soil chemical Analysis .prentice hall of india pvt.ltd.)



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No. NAU/COAB/SSAC/Analysis/ 37-38 /2021

DATE:- 21/09/2021

Subject: - Fertilizer Analysis Report

Name and Address
To,
Anirudhsinh Parmar,
Parul University, Waghodia

Date:- 17/09/2021

Details: - Fertilizer from human urine

Sr. No.	Parameter	Result (%)
1.	Total nitrogen (N)	0.145
2.	Total phosphate (P_2O_5)	7.377
3.	Total potash (K_2O)	0.325

Associate Professor and Head

To measure present amount of nitrogen the test is conducted by Kjeldahl's method and it resulted there is 0.145 % Nitrogen is present in struvite.

Further the presence of phosphate is Analysed by Spectrophotometry (vanado molydo phosphoric acid yellow color method) And there is 7.377 % phosphate present in struvite. And it is high due to the concentration of phosphate in human urine.

There is 0.325 % potash present in struvite. The test was conducted by flame photometry.

As per the analysed value N-P-K is present in desired value which is useful for application as a fertilizer.

Phosphate is an essential nutrient required for plant growth.it helps in root development,plnt maturation,and seed development. Along with nitrogen and potassium , phosphate is one of the most important element in plant life.

5. CONCLUSION

With this project, we could show that an efficient and reliable struvite reactor can be built with locally available materials and at a low cost. Filtration resulted in much higher phosphate recoveries.; more than 90% of phosphate could be recovered, using only little magnesium sulphate and a simple filtration . The accumulation of a filter cake helped to recover most of the struvite state sanitation programs which take into account and promote the societal and environmental benefits of phosphate removal from urine may help to increase sanitation coverage. Last but not least, struvite precipitation can only recover about 20% of the fertilizer market value from urine. A lot of the value is in ammonium and potassium, which remains in the effluent or volatilizes as ammonia.

We can use this struvite reactor at smaller scale for struvite production. Existance of this reactor is avail but It's on larger scale.

6. Reference

1. M Bhuiyan , D. Mavinic et al.Thermal decomposition of struvite and its phase transition. Chemosphere 70, (2008) 1347-1356
2. H. Bhuptawat, S. Chaudhari Innovative physico-chemical treatment of wastewater incrporating Moringa oleifera seed coagulant. Journal of Hazardous Materials 142, (2007): 477-482
3. A. Gunay, D. Karadag et al. Use of magnesite as a magnesium source for ammonium removal from leachate. Journal of Hazardous Materials 156,(2008) 619–623
4. Zs. Ban, G. Dave Laboratory studies on recovery of N and P from human urine through struvite crystallization and zeolite d P from human urine through struvite crystallization and zeolite adsorption. e adsorption. Environmental Technology 25, (2004). 111-121.
5. A. Slivka,., G. Dave et al. Nutrient recovery from human urine using pre-treated zeolite and struvite precipitation in combination ecipitation in combination with freezing-thawing and plant availability tested on common wheat. CLEAN, 36(1), (2008) 45-52.
6. El Rafie, Sh., El Ibiari,et al. Recovery of ammonia nitrogen from industrial wastewater treatment as struvite slow releasing fertilizer. Desalination 214, (2007) 200–214.
7. B. Etter, E. Tilley et al. Low-cost struvite production using source-separated urine, Water Research 45 (2011) 852-86
8. H. N. Bischel ,A. Schertenleib, et al. Inactivation kinetics and mechanisms of viral and bacterial pathogen surrogates during urine nitrification. Environmental Science: Water Research & Technology 1, (2015) 65–76
9. K. M Udert., M. Wächter Complete nutrient recovery from source-separated urine by nitrification and distillation. Water Re- search 46 (2), (2012) 453–464
10. Jackson, M L.(1979).soil chemical Analysis .prentice hall of india pvt.ltd.
11. P. simha et al. Hygiene aspect of treating human urine by alkaline dehydration, Water Research, 144(2018)474-481
12. S. dutta et al. Fertilizer from dried human urine added to ash and lime a potential product from eco-sanitation system,Water Science & Technology , 74.6(2016)14361445