

Preparation of Nano-fertilizer From Banana peels

¹Tushar R. Garad, ²Aditee R.Kokate, ³Rohini D.Patil, ⁴Dr.L.V.Malde

Department of Chemical Engineering,
D.Y. Patil College of Engineering & Technology, Kolhapur,
Maharashtra, India

Abstract: Banana peels are good as fertilizer because they contain 42 percent potassium. Potassium is one of the major component of fertilizer along with nitrogen and phosphorus banana peels contains highest organic source of potassium.using banana peels as nano fertilizer because nano fertilizer are eco friendly.also Nano fertilizer increases nutrient use efficiency (NUE) . It is seen that NUE of nano fertilizer is 3times than chemical fertilizers.as compare to chemical Fertilizer nano fertilizer required 80-90times less so this Fertilizer are more conventional than chemical Fertilizers.

Keywords: Nano fertilizer, Banana Peels, Fenugreek, Tomato Crops

I. INTRODUCTION

A fertilizer or fertilizer is that substance which is used to make soil more fertile such as manure or a mixture of nitrates. It is applied to the soils or to plant tissues (usually leaves) to supply one or more plant nutrients essential to the growth of plants. Hence, we can say in other words that the fertilizers are the chemical substances which are directly respondent for the substantial growth of the plants (trees) or crops and being supply the nutrients in the form of nitrogen, phosphorus, potassium etc. and keep the soils fertile.

Fertilizers is a chemical substances. It's supplied to the crops to increase their productivity.These are used by the farmers daily Because it's increase the crop yield.The fertilizers contain the important nutrients required by the plants, including nitrogen, potassium, and phosphorus.They increase the water reservation capacity of the soil and also increase its fertility.

Harmfull effect of chemical fertilizer. - In the past years we have seen drawbacks may of chemical fertilizer cause soil pollution, water pollution. Excessive we of chemical fertilizer is also affecting quality of crops & it's also increased the acidity of soil. one of the other effects cause by chemical fertilizer is mineral Depletion.that is depelets essential neutrients in the soil.important of nano fertilizer nano Pertilizer is that is made any product.with mane particles.wyes nano techonoly to improve nutrient complete bio source, ecofelendly.

A Nano fertilizer is any product that is made with nanoparticles or uses nanotechnology to improve nutrient efficiency. There are three types of Nano fertilizers have been proposed: 1.Nano scale fertilizer (nanoparticles which contain nutrients), 2.Nano scale additives (traditional fertilizers with Nano scale additives) 3. Nano scale coating (traditional fertilizers coated or loaded with nanoparticles) Nanomaterial coatings (such as a Nano membrane) may Slow the release of nutrients or a porous Nano fertilizer may Include a network of channels that retard nutrient solubility. The use of nanotechnology for fertilizers is still in its infancy but is already adopted for medical and engineer.It is seen that the nano Fertilizers improve the productivity of crops.Also efficiently regulate the delivery of nutrients to plants and required sites and minimal usage of agrochemicals. Nowadays inagriculture, an excess of fertilizer is applied directly into the soil or sprayed on the leaves,because a very low percentage of chemical fertilizer reaches its required site, due to leaching of chemicals, drift, hydrolysis, run-off, and photolytic or microbial degradation. This extra amount of fertilizer badly affects the nutrient equilibrium of the soil, and causes contamination of water supplies, due to the leaching of toxic materials into water. Because of increasing fertilizer nutrient availability in soil Nanomaterial's increase crop yield.

These materials can minimize the crop diseases by acting directly on phytopathogens through a variety of mechanisms.These materials also increase crop production indirectly by improving crop nutrition and increasing plant defense pathways.The efficient use of nano material reduce the negative environmental impact of regular agricultural practices.It has been seen that Nano fertilizers can improve crop productivity by enhancing the rate of seed germination, seedling growth.Nanomaterials work up the plant root and leaf surface, these are the main nutrient part of plant systems also highly porous at the Nano scale. Use of Nano fertilizers increase the nutrient efficiency of the plant through these pores, or the process can facilitate complexation with molecular transporters or root exudates through the creation of new pores, or by the exploitation of endocytosis or ion channels. many of researchers have observed that a decrease in the size of nanomaterials facilitates an increase in the surface mass ratio of particles.This gives the absorption of abundant nutrient ions that is later desorbed slowly and steadily for an extended per formulations of Nano fertilizers can gives balanced nutrition for crops throughout their growth, which helps in agricultural production.

Banana contains important nutrients, this contains could be recycled into useful materials to be reused in different purposes.Removal of mixed nano bio stimulant fertilizer from banana peels is the main moto of this project. Banana peels were not being used for any other purposes and are mostly dumped as waste at huge amount. With increasing environmental consciousness and growing importance of unfriendly agricultural wastes, crops and fruit waste can be used for beneficial conversion into biomaterials like bio-plastic, bio-polymer, and bio-fuels. The approximate N-P-K ratio for a banana peel is 0-3-42, so the peels Banana peels form about 18-33% of the whole fruit mass and are considered as a waste product .At present, these peels are best used in conjunction with other fertilizers if your plants also need nitrogen.

II. METHODOLOGY

Collection & Processing of soil Sample Collection Soil Quality test.

The Soil was Collected from farm yard of Nerle, Sangli District. The Collected Soil was stored in one region under open Condition .The Soil normally contain root, clay, rock pieces these to be removed. The Collected Soil was taken separately and filled with two pot. The soil sample were air dried .This dried soil was packed in polythene bag and sent to Soil quality Center, at Shivaji university lab Kolhapur.



fig 1) collection of soil sample

Collection and Processing of Bonang peels

Banana peels were collected from hot cheeps, Kolhapur. Collected banana peels were clean. Thoroughly with tap water to remove the unwanted material. The washed banana peels were dried into the open to sunlight for 5 to 6 days. The dried banana peels were powdered.

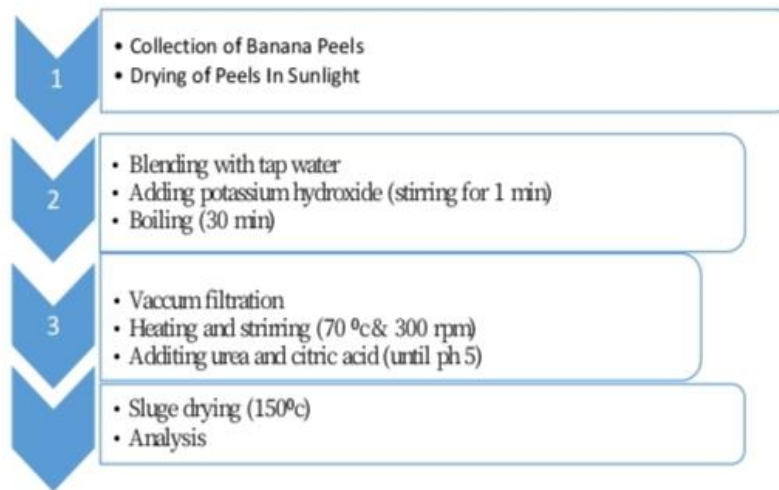


fig 2) collection of Banana peels

Experimentation

Preparation of fertilizer.

1 kg of banana peels powder were taken in 2 lit of water and mixed thoroughly using high speed mechanical blender. The obtained viscous slurry mixed with some quantity of Potassium hydroxide and stirred for 1 min to get homogeneous slurry. This homogeneous slurry was subjected to boiling with continuous stirring for 30 min. After that this slurry kept for cooling room temperature for further processing. This cold slurry was filtered by using vacuum filter to get clear brown filtrate and thick brown sludge. Hence, the clear brown filtrate was heated to about 70°C with continuous stirring. After that were added dropwise 5% solution of urea and citric acid till pH 5. After this procedure the obtained sludge was dried using dryer at 105°C then grinded to fine powder. Desired product was subjected to the physical and chemical analysis

Process Flow chart**III. CHARACTERIZATION OF EXTRACTED FERTILIZER****Determination of quantity of extract**

The obtained alkaline filtrate of extract was treated with concentration nitric acid in a closed vessel at elevated temperature and pressure. The resulting solution was diluted, and extract contents were determined by atomic absorption spectroscopy (AAS) using a flame method Apparatus includes the PerkinElmer 2100 atomic absorption spectrophotometer and a hollow cathode lamp for the element to be analyzed. Tryptophan and total protein were measured according to the procedures.



Fig 3) Photo of banana Peels and banana extract

SOIL TEST -: (N-P-K And pH Value)

With a proper soil fertility management strategy, farmers can maximize the efficiency of nutrients and water use and improve their agricultural productivity. Soil testing gives valuable information and helps you improve your soil's health. Knowing the exact nourishing found in your farm soil and the pH is the first step of any healthy crop production program. Crops are usually grown on a very vast variety of soil types and different fertilizer requirements, depending with the soil health and condition. Application of many nutrients can result to imbalance in soil and eventually affecting the environment and pollutant water and the beast beneath.

Transmission electron microscope test (TEM)

The obtained nanoparticles were characterized by means of a JEOL-JEM1200 transmission electron microscope (TEM). The TEM sample was made ready for use by adding a drop of the nanosolution on a 400 mesh copper grid coated by an amorphous carbon film and letting the sample dry in an open air at room temperature. The average diameter of nanoparticles was determined within the range of 100 nm that was found in several chosen areas in enlarged microphotographs.

X-ray diffraction (XRD)

X-ray diffraction (XRD) analysis was done for the presentation and corroboration of the integration. Chemical examine also indicate the sorption of fertilizer material into zeolite at categorize moisture condition to see the release of the fertilizer materials and was compared with other fertilizer. The release pattern of nutrients from either source showed a substantial decreasing movement with time although the release of P and K was higher for nano fertilizer than the standard one. Investigation appear higher accumulation of P and K in plants increase with nano fertilizer. Post-effect of nano fertilizer application in soil showed better pH, moisture, CEC, available P and K under nano fertilizer dealing than the conventional fertilizer.

X-ray diffraction is based on Bragg's law ($n\lambda = 2d\sin\theta$). A monochromatic beam of X-rays is allowed to incident on a sample, and reflected X-rays are discovered by a detector. X-ray diffraction pattern is a characteristic of the substance under examination.

IV. APPLICATION OF EXTRACTED NANO FERTILIZER IN AGRICULTURE

Seeds of two vegetative crops (tomato and fenugreek), seeds of each crop, were used, and the seeds were cultivated in texture soil taken from the soil in a village Nerle from sangli district.

Assesment of soil quality from Islampur area of Sangli district, Maharashtra have been studied. Physical and chemical properties were considered for assessment of soil quality in the month of January, 2009 for present study. Physical properties showed maximum water holding capacity 76.81%, porosity 61.13%, expansion in volume 18.53%, absolute specific gravity 1.92 gm/cc, chemical characteristics revealed soil pH 8.3, specific conductance. 0.80 ds/m and organic carbon 1.48%, available phosphorus 6.50 kg/ha, accessible potassium 1169.28 kg/ha, inconstant calcium 43.48 mL equiv.%, magnesium 21.87 mL equiv.%, sodium 1.18 mL equiv.% and free lime 11.70%. The seeds were irrigated using water of total salinity of 450 ppm amount of 40% of soil weight with the addition of different doses (4, 8, 12, and 16 ml/l) of nanofertilizer extracted from banana peels. After 7 days, data concerning with germination percentages were recorded and variances were analyzed.

V. CONCLUSIONS

Nano fertilizer can be extracted from banana peels under alkaline conditions by using potassium hydroxide. In this process it was found that the extract of banana peel by alkaline hydration contains about 75g/L of elemental potassium chelated with citric acid. Also, other this there are minerals such as iron, magnesium, copper, sodium, calcium, and manganese chelated with citric acid in a nanostructure form. Extract contains constituents of spherical nanostructure, having major particle size (45 nm). The obtained nano fertilizer gives great crop yield in the first planting week for both fenurgreek and tomato so it is recommended as a biological promoter for seed germination and seedling growth performance. Utilizing nanotechnology to transfer the banana peel extract from normal form to nanoform added a positive value for this extraction and reinforced its positive impacts as growth promoter. Based on the lab scale results obtained in this study, we can do future investigations on the pilot and industrial scale with co-operation with agriculture engineering and professors taking into consideration the soil types, seeds varieties, irrigation water, and nanofertilizer economics.

VI. DISCUSSION AND RESULTS

Soil analysis

Nano bio fertilizer can be extracted from banana peels under alkaline conditions. Utilizing nanotechnology to transfer the banana peel extract from normal form to Nano form added a positive value for this extraction and positive effects as growth promoter. We did the soil sample test before application of a fertilizer for the analysis of the presence of the N-P-K Fertilizer in that soil.

Table 1 Result of soil Before applying the fertilizer.

Sr.no	Parameter	Unit	Soil	Analysis Method
1	pH	-	7.20	IS 3025 Part 11
2	Phosphorus	%	0.001	Stannous Chloride Method
3	TKN	%	0.021	Kjeldahl Method
4	Potassium	%	0.011	Flame Photometer
	Abbreviation TKN-Total Kjeldahl Nitrogen			

TEM analysis

Figure 4) shows the TEM analysis of the obtained banana peel extract using potassium hydroxide as extracting agent. It is understood that nanospherical shape particles were get with size ranged from 19 to 55 nm, while Fig.7 shows the histogram of the obtained nanoparticles from banana peel extract.

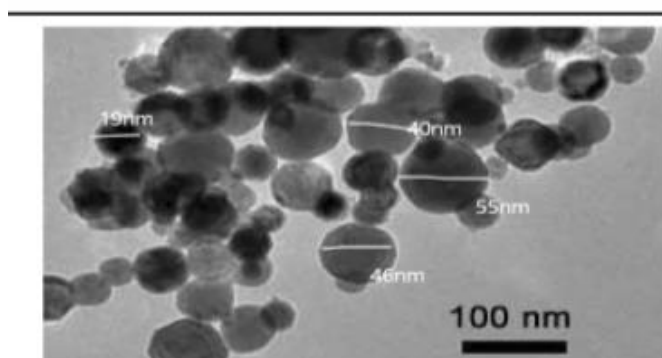


Fig. 4) TEM analysis of banana peel extract using alkaline extraction(1)

Additionally, the major nanoparticles are of 40 nm with an average percentage of 36% while 55-nm particles were the minor size with an average percentage of 6%. Figure 4 constitute the effect of potassium hydroxide concentration on the potassium extraction process from banana peels at boiling conditions. The operating conditions were solid to liquid ratio 1:2, temperature 100 °C, and cooking time 30 min. So it is obvious that as the potassium hydroxide concentration increases the extracted potassium from banana peels increases starting from 46 g/l at 4 g potassium hydroxide to 87.8 g/l at 20 g potassium hydroxide. However, the potassium extraction efficiency increases from 44 to 94% via adding potassium hydroxide from 4 to 20 g. addition of potassium hydroxide over

10 g shows no remarkable an increase in potassium extraction efficiency. Hence, about 10 g potassium hydroxide was get hold of as an optimum concentration. Table 2 constitute the effect of potassium hydroxide concentration on the extraction of tryptophan and total protein from banana peels. The results show that as the potassium hydroxide concentration increases both of tryptophan and total protein extraction efficiency increases to reach its maximum value (on addition of 20 g potassium hydroxide). However, with respect to the differences in extraction efficiency and the economic aspects, 10 g of potassium hydroxide was taken the optimum weight.

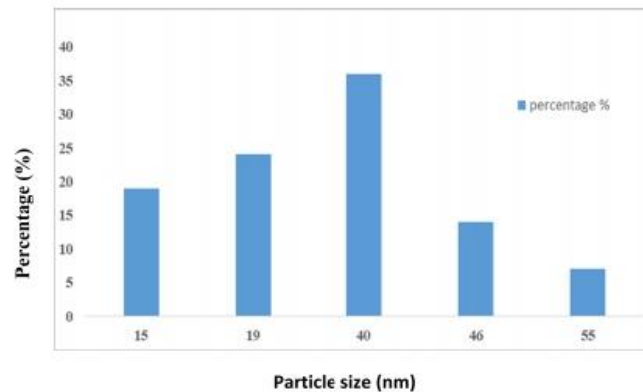


Fig. 5) Histogram of banana peel extract using alkaline extraction(1)

Banana peel extract personation Nano-fertilizer was prepared from banana peels (as seen in Fig.3), using potassium hydroxide as removeing agent at optimum operating conditions (solid to liquid ratio 1:2, temperature 100 °C, and cooking time 30 min). The results of TEM manifest that the major nanoparticles are of 40 nm with an average percentage of 36%. Conversion to nanostructure is attributed to the presence of both urea and citric acid, as citric acid reacted with the minerals, forming mineral citrate, while urea is used as a carrier for these mineral citrate in the nanoform. As shown in Fig. 4, increment of potassium hydroxide concentration enhances the extracted potassium from banana peels and 10 g was taken as optimum. Also, it is known that alkaline medium increases cellulose

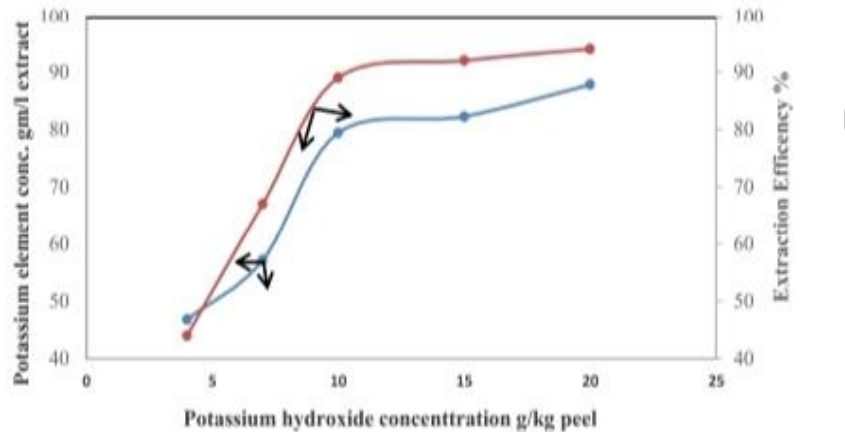


Fig. 5 Effect of potassium hydroxide concentration on potassium element extraction from banana peel(1) solubility during a digestion process of banana peels that results in liberating the micronutrients of tryptophan and total protein extraction efficiencies which reaches maximum value on using 20 g potassium hydroxide. However, with respect to the differences in extraction efficiency and the economic aspects, 10 g potassium hydroxide was chosen as the optimum value.

Table 2 Effect of potassium hydroxide dose on tryptophan and total protein extraction (1)

Sample code	Potassium hydroxide. g/kg dry peel	Tryptophan mg/ l extract.	Tryptophan extraction. efficiency %	Total protein g/l . extract.	Protein extraction efficiency %
1	4	119.	23.	1.9.	36.53
2	7	217.	41.97.	3.3.	63.46
3	10	494.	95.55.	4.9.	94.23
4	15	497.	96.13.	4.96.	95.38
5	20	497.	96.13.	4.97.	95.57

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