

MUSA PAPYRUS

*Going bananas with bananas to manufacture
environment friendly paper for the future!*



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SCOPE:

The idea of the project is to manufacture 100% Eco friendly Biodegradable Paper from the leftover peels of bananas.

Several centuries back, paper was made from the cellulose of linen and other cotton rags. Though manufacture of paper from wooden pulp is easier than from cotton and linen cellulose, the strength of its polymer chains is less than that in plants. Banana peels contain up to 15% of cellulose. As banana peels are a more common part of any household's everyday garbage as compared to cloth fibers, utilizing the cellulose in banana peels to manufacture paper will considerably reduce human impact on environment. This is the basic idea behind 'Musa Papyrus'.

The technique is relatively easy and does not require extensive or expensive machinery. This makes it available to all people regardless of status. In addition, as bananas are available throughout the world, geographical bias does not come into play.

OBSERVATION AND ANALYSIS:

Process Followed:

The banana peels are first peeled and dried in the sun. The extent of drying of the peel depends on the colour of paper desired. Extreme drying results in dark brown colour due to exposure to sun. The peel should then be cut into pieces and boiled. Drying results in closure of the pores in the fiber as well as resistance to swelling on rewetting. Once the peel has been boiled it must be blended with water to create a mesh. Then the mesh must be spread evenly on cloth for drying. Its thickness depends on the required size. Banana peels can be used to make paper as well as thicker sheets resembling cardboard. Thicker sheets can be used as cardboard, covers for notebooks, etc.

Experimental Values:	Time of Drying in the Sun:	Proportion of peel to water:	Observations (quality of paper);	Analysis:

Attempts:				
1 st Attempt	48 hours	1:3	Paper is very dark and watery, cannot be used for writing	Less water must be added to improve its consistency.
2 nd Attempt	48 hours	1:2	Paper is slightly thicker, but too dark for visibility and is cracked.	Must be dried for a shorter period to lighten the colour.
3 rd Attempt	24-25 hours	1:2	Paper is slightly lighter and thicker but a little flexible and is still curved.	Colour to be improved further. Paper can be thicker.
4 th Attempt	15 – 18 hours	1:1.5	Paper was made as a huge sheet but it was cracked in the centre which made it ineffective.	Paper directly boiled instead of drying which improves colour. Extra ingredients may be mixed to examine output.
5 th Attempt	12-15 hours	1:1.5	From this attempt onwards, raw banana was used. Corn husk was added to examine the texture. Paper cannot be used.	Too much corn husk renders paper ineffective.
6 th Attempt	5-6 hours	1:1	Lesser corn husk was added but paper texture is still not desirable.	Corn husk does not suit requirements. Colour must be reduced by some other methods.

7 th Attempt	-nil-	1:0.5	No corn husk was added. Instead homemade starch was put in. Paper showed wanted characteristics.	Paper is finally utilizable.
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To manufacture Musa Papyrus, we tested and experimented with several combinations until we achieved the desired qualities in our paper. Through observation and analysis we came to the conclusion that different types of peels suited different expectations of ours. Also, due to the characteristic of banana peels to turn brown, we achieved only dark coloured paper. This was suitable for notebook coverings. However, we wanted to take it one step further and manufacture paper which could be used for writing as this would reduce the burden on Mother Nature to a large extent. To overcome this obstacle, we added starch to the mesh before drying. Also, we realized green coloured banana peels were much more suitable for this task. However, since using unripe banana peels made the fruit inside unusable, we decided to use raw banana (vazhakka) peels instead as the part inside could still be used. As the starch in shops has chemical content, we produced starch at home by boiling sago which is rich in its content. On adding it to the mixture and drying it resulted in a lighter color paper, which on testing was found to be perfect. It took approximately 2 raw banana peels to make a sheet of A4 size. After several futile attempts, we successfully adopted a method which produced advantageous outcomes.

The exact log book of our activities has been attached to the end of this document.

RESULTS OF THE PROJECT:

It was found that after several attempts the 'Musa Papyrus' displayed desirable attributes. The correct proportions of water and banana peel along with the extent of drying and other extra ingredients were the key factors in determining and altering the texture of the paper. We realized that on trying with various new ingredients we would be able to achieve papers of different textures, thickness and colours for our various purposes.

Our experiments based on our project yielded fruitful results. We finally achieved a paper of light tone which can be written on with pencils, gel pens, ball point pens and ink pens. It can also be used as craft paper or cardboard if processed as a thicker sheet.

CONCLUSIONS:

If this project is implemented on a large scale, the paper can be fine tuned and made in a professional way. Its thickness can be made uniform and can be projected to the public for usage. This project is ideal as it solves the problem of deforestation in a simple manner. It also aids in overcoming the problem of waste management as banana peels also contribute to waste even though they are bio degradable. Paper made at home may not be completely professional but is still sufficient enough to meet the trivial everyday needs of a common man.



BENEFITS TO ENVIRONMENT:

The ever growing population is exploiting nature's resources to the maximum. The green cover of the earth is declining drastically and suitable substitutes for wood like banana peel will go a long way in healing the world. Manufacturing paper from banana peel trims down the demand for cutting of trees. This in turn has several environmental benefits such as reduction of air pollution, hindering global warming and maintaining the ecological balance.

Also banana peels, if not composted, form a major part of the garbage disposal. Shrinking of this burden on nature too has its positive impacts in the environment.

BENEFITS TO OTHERS:

Musa Papyrus is made from vegetable waste. The ingredients used are simple, harmless yet effective in their purpose. It will also be economically viable due to its undemanding process of manufacture.

Looking beyond the benefits provided to the environment of the world, manufacture of Musa Papyrus opens up a new industry and provides employment opportunities to both skilled and non skilled workers in India. This can help boost our country economy and environment at the same time.

Musa Papyrus can be used to make papers, notepads and even notebooks if manufactured in an engineered method. Based on its thickness it can be utilized as paper, craft paper, gift paper or even cardboard for covering the notebooks.

LOG BOOK OF ACTIVITIES

Attempts and date:	PROCEDURE:	OBSERVATION AND ANALYSIS:	RESULT:
1 ST Attempt: 2/11/13	<ul style="list-style-type: none"> Used ripe banana Dried in sun Boiled the cut pieces in water Grinded to obtain a mesh Mesh dried on cotton cloth 	<ul style="list-style-type: none"> Too hard and stiff Not straight and cannot be used for any purpose Breaks instead of tearing Irregular shape Cannot be stapled or stuck 	Failure
2 ND Attempt: 16/11/13	<ul style="list-style-type: none"> Used unripe yellow banana Dried in sun till it turns light brown Boiled the small pieces in water Grinded to a mesh with lesser water Mesh was cooled before spreading Cooled mesh is spread on cotton cloth and dried 	<ul style="list-style-type: none"> Slightly lighter in colour but still ineffectual Too thin and cracked Cannot be written on 	Failure
3 rd Attempt: 24/12/13	<ul style="list-style-type: none"> Used unripe banana Dried in sun Boiled in water Grinded to a mesh with lesser water to prevent 	<ul style="list-style-type: none"> Paper is cracked Very thin Colour is slightly improved Cannot be used for any purpose as it is too fragile 	Failure

	<ul style="list-style-type: none"> mesh from become liquid Spread on cotton sheet and left to dry 	and cracked.	
4 th Attempt: 28/12/13	<ul style="list-style-type: none"> Used unripe banana Dried for a lesser time in the sun to improve colour Boiled in water Grinded to a mesh with a considerably less amount of water to thicken the paper Spread on cotton cloth to dry in a larger amount 	<ul style="list-style-type: none"> Colour is much lighter Paper is more thicker Paper is larger in size and is fine at the edges but cracked towards the middle Cannot be used for any practical purpose 	Failure
5 th Attempt: 4/1/14	<ul style="list-style-type: none"> Used raw banana Dried in sun for a lesser amount of time Boiled in water along with cut pieces of corn husk to test for improvement in texture Grinded into a mesh though corn husk does not grind completely Spread on a silk cloth to prevent cracking and curvature of paper 	<ul style="list-style-type: none"> Due to excess of corn husk paper lo longer resembles paper Silk cloth prevents cracking of paper and is therefore one of our positive changes Cannot be used for anything 	Failure
6 th Attempt: 18/1/14	<ul style="list-style-type: none"> Used raw banana Dried for a very short period of time Boiled in water Grinded to a mesh with less water and lesser of corn husk Spread on a silk cloth to dry 	<ul style="list-style-type: none"> Paper is considerably better but not up to the mark Corn husk does not seem to be a desirable component Paper once again can perhaps be used to covers but not for writing 	Failure
7 th Attempt: 1/2/14	<ul style="list-style-type: none"> Used raw banana Not dried in sun at all Boiled in water Starch solution prepared by boiling sago which is rich in starch to lighten the paper Grinded to a mesh with very less water so that the mesh is very thick Spread on a silk cloth 	<ul style="list-style-type: none"> Paper is very light as compared to previous attempts Writing is possible As starch is also chemical free paper is completely harmless Made with different proportions of starch to test colour and is found effective 	Success

PROCESS OF MANUFACTURE:

Step 1:

Peel the banana



Step 2:

Cut it into small
pieces.



Step 3:

Boil them in
water.



Step 4:

Grind into mesh
with starch



Step 5:

Spread on silk
cloth



Step 6:

Once dried,
paper is ready!



(Video and specimens of paper to be displayed with presentation during exhibition on February 22)

DETAILS :

This project aims at resource conservation.

However, it also aids waste management.

EXPENSES FOR THE PROJECT:

- ✚ Banana: Rs 5
- ✚ Vazhakka: Rs 5
- ✚ Cloth: Rs 40

Several bananas and vazhakkas were purchased.

1. How were the expenses met?

The expenses were provided for by self. Financial support from IWMA is unnecessary.

2. Have you presented the project elsewhere? If so, when and where?

No, this is the first time we are experimenting with such a project.

3. Have you been awarded for the same project? If so, when and where?

Not applicable as it is our first time.