

~~Waste~~ Wealth

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EFFICACY OF NATURAL ADDITIVES IN RECYCLED PAPER FOR USE AS SHELF LINER FOR PREVENTION OF INFESTATION BY HOUSEHOLD PESTS

- **PROBLEM:**A common household problem is invasion by pests such as cockroaches, silverfish, ants, termites ,moths.



- THE EFFICACY OF MOST **COMMERCIALLY AVAILABLE HOUSEHOLD PEST REPELLANTS** THAT ARE AVAILABLE ARE POTENTIALLY **TOXIC** AND OFTEN POSE A **HEALTH HAZARD** WHEN THEY COME IN CONTACT WITH **KITCHEN UTENSILS, FOOD ITEMS, CLOTHING AND STATIONERY ITEMS** STORED IN OPEN SHELVES AND CLOSED CABINETS.



TRADITIONALLY, INDIAN HOMES HAVE

- used **plant based repellants** to control the menace.
- For instance, dried **Neem leaves** are spread under a paper liner in wardrobes; **neem and clove** sachets are tucked strategically in storage drawers, even **in rice and grain bins**.



Objective

1. To prepare recycled paper using commonly occurring herbs and natural waste material such as Neem (*Azadirachta Indica*) leaves.

(other variations- onion skin, garlic skin,neem bark,neem seed residue)

2. To explore qualitatively the effect of “Herbal” Paper on common household pests such as ants, cockroaches and silver fish.

Methodology

Preparing Neem Paper

- 1. Shred used notebook sheets or scrap paper into small pieces. Put the shredded paper
- into a bucket, cover with water, and stir till completely wet. Leave over night to soak
- completely.
- 2. Grind the paper finely using the mixer/grinder available at home in small lots to make
- paper pulp. About 600 g of paper pulp is needed to make 6 sheets of recycled paper.



- 3. Take Neem leaves and grind to make 200 g of pulp using the mixer/grinder.
- 4. Take six bowls labeled as C, A1, A2, A3, A4, A5. Bowl C will be the 'control' paper pulp with no additive.



- Add the ingredients as given below and mix well.

Ingredient (in g)	Bowl C	Bowl A1	Bowl A2	Bowl A3	Bowl A4	Bowl A5
Paper Pulp	100	100	100	100	100	100
Neem Pulp	Nil	10	20	30	40	50
Arrowroot Starch	05	10	15	20	25	30
Alum Powder	10	20	25	30	35	40

- Now you have paper pulp with 5 different concentrations of Neem additive. Mix thoroughly.

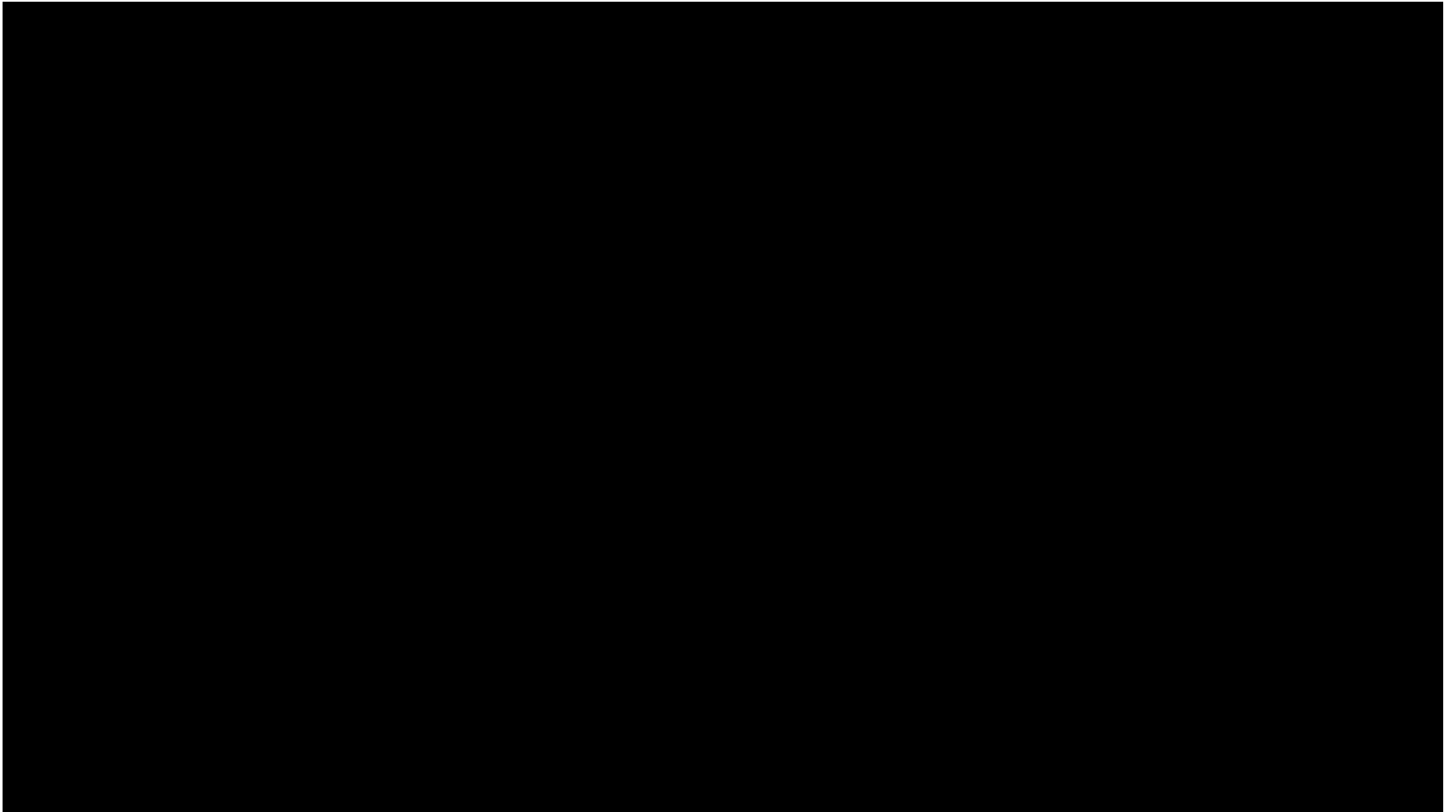
- 5. Take the wire gauge strainer and spread the pulp from Bowl C evenly on it to make a sheet of paper. It helps to dip in a slightly bigger shallow trough of water to get an even Ingredient spread of pulp. Spread a muslin cloth slightly bigger than the size of the strainer.
- When the excess water has drained out, lift the paper sheet along with the cloth lining



- Place on a hard surface (ply board or table) and press under a wooden board to smoothen the surface. Remove from under the board and leave it to dry hung on a clothes line in the sunshine. When dry, separate from the cloth lining.



Making paper from waste



- Repeat the process to make paper sheets from the pulp containing Neem additive in the remaining bowls.



- When dry, label the sheets as C, A1, A2, A3, A4, A5. Trim the edges slightly to make these of equal size.

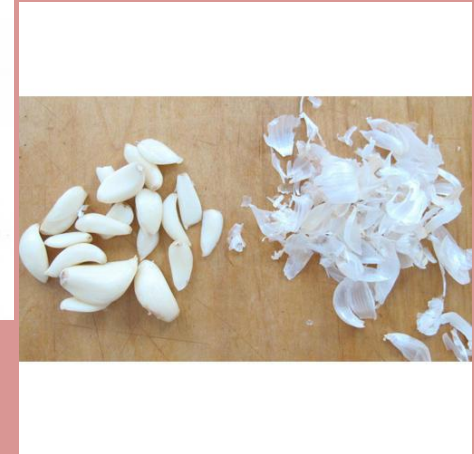
Investigating the effect on household pests

- Collect pests such as ants, cockroaches, silver fish, and termite.
- Place a counted number of pests on it.
- Observe their behavior to record the time spent by the pests on the paper.
- Record your observations on the motion in the Table ,for a specific pest, repeating the experiment for at least 10 days.

- Repeat this with each of the papers labeled A1, A2, A3, A4, A5.
- The experiment can be carried out for a longer duration to test the duration for which the paper with additive retains its property.
- Repeat with other pests, recording observations in similar tables.

Effect of other herbal additives

- Repeat the experiment making paper with other additives such as *Pudina/ Mint* leaves



- *Citronella* grass,
- *Turmeric*, garlic and onion peels

- Orange (*Citrus reticulata*) peels, Lemon (*Citrus limon*) peels, Cucumber (*Cucumis sativus*) peels.



- Record your observations in tables similar to that given above, for different pests

Conclusion

From the above data, draw conclusions about which herbal paper is the most effective in repelling household pests.

- **HOW EFFECTIVE DIFFERENT HERBAL PAPERS ARE IN REPELLING HOUSEHOLD PESTS?**
- **WHAT IS THE EFFECT OF CHANGING THE CONCENTRATION OF THE ADDITIVE?**
- **HOW LONG DOES THE PAPER WITH ADDITIVE RETAIN ITS PROPERTY?**
- **DOES EACH ADDITIVE HAVE THE SAME EFFECT ON DIFFERENT PESTS?**
- **WHICH ADDITIVE IS MOST EFFECTIVE FOR A PARTICULAR TYPE OF PEST?**
- **IF INSTEAD OF PAPER SHEETS, HERBAL BALLS ARE PREPARED FROM THE MIXTURES IN BOWLS A1, A2, A3, A4, A, WOULD THEY BE EQUALLY EFFECTIVE IN REPELLING THE PESTS?**

SIMILAR PROJECTS

- YOU can TRY TO PREPARE A MIXTURE WITH PAINTS AND WAX TO COAT IT ON THE WOOD AND CHECK ITS EFFICACY FOR DIFFERENT INSECTS.

-NEEM OIL

-NEEM BARK

-NEEM SEED RESIDUE

-LEMON GRASS OIL.



MAKING CARDBOARD BOX WITH DIFFERENT ADDITIVES

-CHECKING ITS EFFICACY FOR DIFFERENT
INSECTS.



BOX HAVING GOOD EFFICACY CAN BE USED TO
STORE VALUABLE DOCUMENTS IN SCHOOLS,
OFFICES AND HOUSES.

PROJECT-II

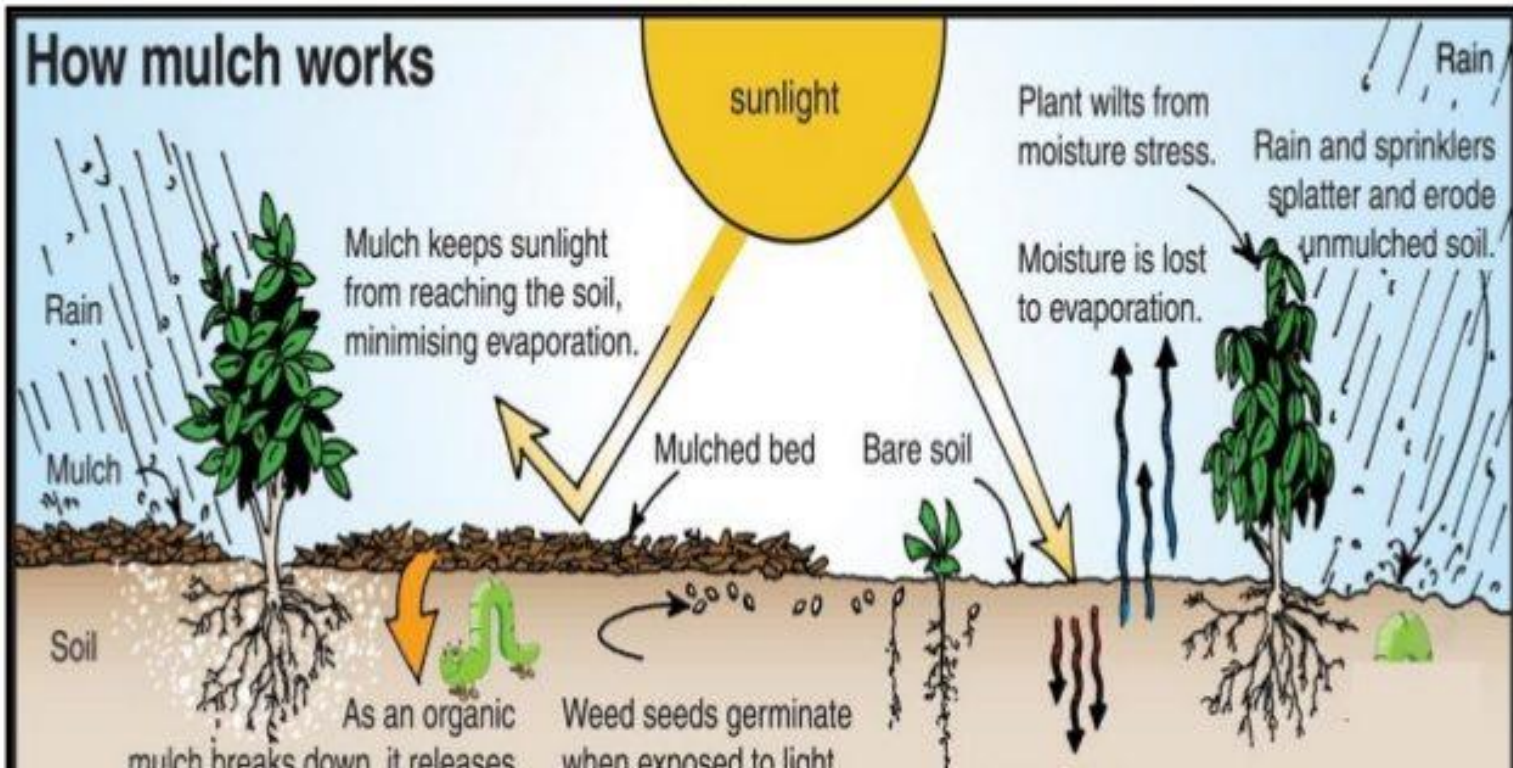
EFFECT OF APPLYING DIFFERENT WASTE MATERIAL AS MULCHES, ON POPULATION DENSITY OF MACRO-ORGANISMS

- A MULCH IS A LAYER OF MATERIAL APPLIED TO THE SURFACE OF SOIL FOR CONSERVATION OF SOIL MOISTURE, IMPROVING FERTILITY AND HEALTH OF THE SOIL, REDUCING WEED GROWTH.



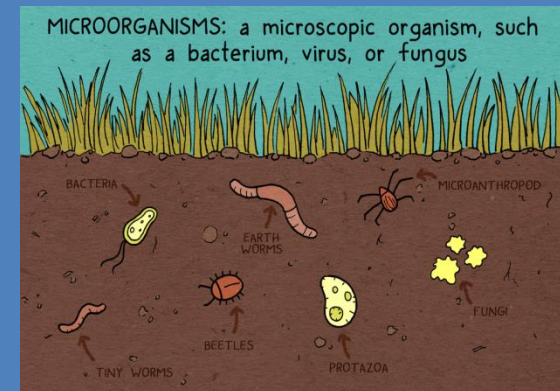
- A MULCH IS USUALLY, BUT NOT EXCLUSIVELY, ORGANIC IN NATURE.

How mulch works



HOW MULCH HELPS.....

- MACRO-ORGANISMS SUCH AS **EARTHWORMS** ARE REGARDED AS FARMER'S BEST FRIEND.
- THEY ARE **RESPONSIBLE FOR SOIL DEVELOPMENT**, RECYCLING ORGANIC MATTER AND FORM A VITAL COMPONENT WITHIN MANY FOOD WEBS.



OBJECTIVE

- **1. TO IDENTIFY DIFFERENT WASTE MATERIAL THAT CAN BE APPLIED AS MULCH.**
- **2. TO STUDY ABOUT THE EFFECT OF DIFFERENT MATERIAL AS MULCH ON EARTHWORM POPULATION DENSITY.**

Materials Required

- SEVEN SAMPLE PLOTS OF 1M X 1M IN FARM OR GARDEN SOIL; PEGS AND STRING.
- WASTE MATERIAL TO BE USED AS MULCH – **COCONUT HUSK, FRUIT AND VEGETABLE WASTE, POLYTHENE BAGS** – 1 KG PER PLOT, WEIGHING BALANCE; SPADE, TRAY

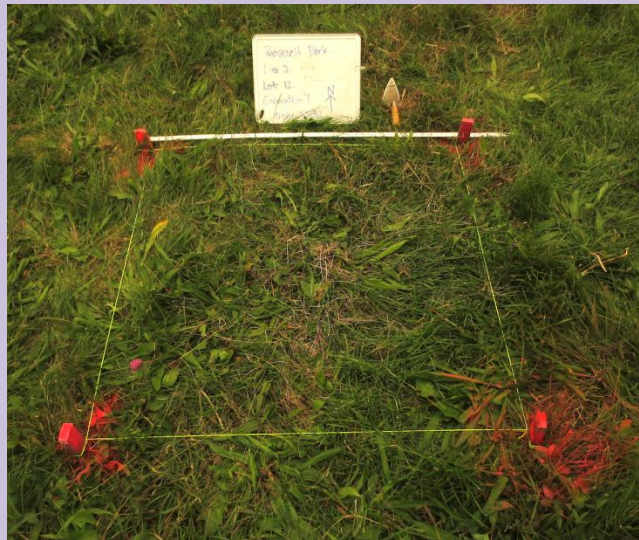


Methodology

- IDENTIFY THE AREA WHERE YOU WILL CONDUCT THE EXPERIMENT- **FARM, KITCHEN GARDEN, SCHOOL GARDEN.**



- DEMARCATe **SEVEN PLOTS OF 1M X 1M** EACH KEEPING AT LEAST 1-2 M DISTANCE IN BETWEEN THE PLOTS.



- Randomly label the plots as **C, A1, A2, B1, B2 , D1, D2**
- Plot **C** will be the ‘control’ plot while plots **A1, A2, B1, B2 , D1, D2** will be covered with different types of waste materials as mulch.
- Each treatment will be **replicated twice**.

- BEGIN BY TAKING **FIVE RANDOM SAMPLES**. USING A SPADE, DIG UPTO A DEPTH OF 15 CM AND COLLECT THE SOIL CAREFULLY ALONG WITH ALL THE MACROANIMALS.



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The collected soil is to be kept on a tray and of earthworms to be counted. Note their number in the given table 1. Reintroduce the soil back to the plot after the count.

Table-1: Initial information on earthworm population density		
Sample collected	No. of Earthworms Present	Mean (Total no. of Earthworms/ No. of samples)

- The plots will be now prepared for experiment. Apply coconut husk mulch to plot A1, A2.



- Apply vegetable and fruit waste mulch to plot B1, B2.



- Apply shredded polythene bag to
- plots D, D2.



- **OBSERVATIONS ARE TO BE TAKEN OVER A PERIOD OF ONE MONTH.**
- **AFTER EACH WEEK, SOIL SAMPLES ARE TO BE COLLECTED FROM EACH PLOT FOR COUNTING EARTHWORM POPULATION AND ARE TO BE RECORDED IN TABLE 2.**

Table 2

Treatments	No. of Earthworms present			Mean		
	Week 1	Week 2	Week 3	Week 4	Week 5	
A	A1					Mean value of A
	A2					
	Mean					
B	B1					Mean value of B
	B2					
	Mean					
D	D1					Mean value of D
	D2					
	Mean					
C						Mean value of C

DATA ANALYSIS

- The next step is to compare the population density with respect to control.
- Data can be presented using simple statistics and mathematics.

Conclusion

FROM THE ANALYZED DATA, CONCLUSION TO BE DRAWN IF **DIFFERENT MULCH HAS ANY EFFECT** ON POPULATION DENSITY OF MACRO organisms



PROJECT -III

EFFECT OF APPLYING DIFFERENT WASTE MATERIAL AS MULCHES, ON RETENTION OF WATER CONTENT IN THE SOIL



What is Water Content of Soil?

- WATER CONTENT OF A SOIL MASS IS DEFINED AS THE **RATIO OF WEIGHT OF WATER PRESENT IN A GIVEN SOIL MASS TO THE WEIGHT OF DRY SOIL.**
- i.e. **water content = (weight of water in soil mass)/(weight of dry soil)**
- Water content is usually expressed in percentage (%).

How Much Sample Required for Test?

THE MINIMUM AMOUNT OF SAMPLE REQUIRED FOR THE TEST IS PRIMARILY DEPENDENT UPON THE **MAXIMUM PARTICLE SIZE** PRESENT IN THAT GIVEN SOIL MASS.

**Maximum particle size in the soil
(mm)**

Minimum weight of soil sample (g)

0.425

20

2.0

50

4.75

100

10.0

500

19.0

2500

EQUIPMENTS NEEDED

- Moisture cans (must be made of heat resistant material)
- Oven with temp. control (105°c to 110°c)
- Desiccator (used for cooling)
- Balance (having a readability of 0.01 g for specimens having mass of 200 g or less and 0.1 g for specimens having mass of over 200 g.)

STANDARD TEST PROCEDURE TO FOLLOW

- Determine the **weight (g) of the empty moisture can** plus cap (W_1), and also record the can number.
- Place the required amount of moist soil in the can with its cap **to avoid loss of moisture**.
- Determine the **combined weight of the can and moist soil** (W_2).
- **Remove the cap** from the top of the can and place it at the bottom of the can.
- Put the can with moist soil sample **in the oven for 24 hours**.
- **After complete drying of soil mass**, remove it from the oven and let it cool down to **room temperature** inside a desiccator. Determine the **combined weight** of the dry soil sample plus the can and its cap (W_3).

CALCULATIONS INVOLVED

- Calculate the weight of moisture = $W_2 - W_3$
- Calculate the mass of dry soil = $W_3 - W_1$
- Calculate the water content (%) as given below
- **$w (\%) = [(W_2 - W_3) / (W_3 - W_1)] * 100$**

HOW TO REPORT TEST RESULT?

- Minimum of **three numbers of specimens** of the same sample should be tested.
- The **average value of the 3** observations should be reported.
- The water content of the soil is reported to two significant figures.

SAME PROCEDURE AS PROJECT-II

- INSTEAD OF COUNTING MACRO ORGANISM,
- MOISTURE CONTENT IS DETERMINED FOR VARIOUS TYPES OF MULCHES.

VARIOUS TYPES AND SHAPES OF PLASTIC PAPER CAN BE USED AS MULCHES



Project-IV

EFFECT OF APPLYING DIFFERENT WASTE MATERIAL AS MULCHES, ON THE WEED GROWTH CONTROL



MULCHING WITH PLASTIC SHEET



MULCHING CAN BE TRIED WITH
PLASTIC WASTE TO CONTROL
WEED GROWTH

Recycling of chalk pieces

-Broken & used chalk pieces

Making colored and white chalk again from the waste chalk pieces.

- **collection of broken chalk pieces from each class.**
- **Assessing the quantity of waste generated per week , per month, per year.**
- **Production of chalk pieces from the waste generated.**

Making white classroom chalk

To make white classroom chalk, the waste chalk is grounded to fine powder and added water to form a thick slurry with the consistency of clay. The slurry is then placed into and extruded from a die.



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Three metal school chalk moulds are shown, each with a grid of 240 small holes. They are arranged side-by-side against a green background.



The sheet is then placed in an oven or open direct sun light. After it has cured, it is packed in the wooden box.

Making colored classroom chalk

- Pigments (dry, natural, colored materials) are mixed in with the grinded waste chalk pieces.
- Water is then added to the mixture, which is then baked in the same manner as white classroom chalk.



White washing

Assess the amount of waste chalk piece generated.

Grind it in to powder, to be used for white washing of the class room after mixing with calcium hydroxide + white cement.

Economic analysis of recycled chalk pieces can be done as a project.

- Quantity OF CHALK WASTE GENERATED PER YEAR.
- Quantity of chalk recycled per year.

Feed for animals from food waste

- Waste food can be dehydrated and stored for months and used as feed for animals.

Source can be –vegetable waste, mid day meal waste from schools and hostels.

Find a effective process to dehydrate.-**PROJECT**



Fuel (like cow dung cake) from waste food

- -waste food can be dehydrated and used as fuel like a cow dung cake.



Waste food can be dehydrated and stored for months and used as fuel to cook.

Source can be –vegetable waste, mid day meal waste from schools and hostels.

Find a effective process to dehydrate.- **PROJECT**



Waste soap

- Waste soap bits can be collected from the houses of students in your school.
- Make some arrangements in your school to collect the waste.



Can be recycled to liquid or solid soap and used again by the students for washing their hands at school before lunch and after playing.



