Sludge Pot-An Unconventional Planting Pot From Pulpwood Industrial Waste

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ABSTRACT

Effluent sludge, a byproduct in the pulpwood industry has been used to make planting pots. These sludge pots have economical and practical/operational advantages over the conventional polybags. The root system can penetrate through the sludge bag due to its porous nature. As they contain cellulosic fibre the pots improve the water retention capacity in the rhizosphere.

Due to these inherent advantageous properties of the pot material the seedlings grown in sludge pots can be directly transferred to the pits in the field without removing the pot. Undisturbed soil block in this case improves the establishment percentage of the plants.

INTRODUCTION :

In the newsprint manufacturing, some fibres and fillers are lost from different pulping and paper making sections. The back waters containing suspended solids coming from different sections are segregated into high solid sewer and low solid sewer. The high solid sewer effluent is rich in suspended solids and given primary treatment in a clarifier. Here the sedimentation of solids occurs and the settled sludge is pumped out and filtered of on a vaccum filter. Effluent sludge cotains organic and inorganic compounds. The major source of organic compounds is fibre which contribute to about 75% to 85% of effluent sludge and the inorganic compounds amount to 15% to 25%. This byproduct can be advantageously used for making planting pots which appears to have useful qualities compared to the conventional polythene bags. The sludge output is four tonnes (oven dry wt.) per day in this mill.

MATERIALS AND METHODS :

The mould for making sludge pots was fabricated in HNL workshop which has the following parts (Fig. 1) a. outer shell, b. nylon wire mesh, c. inner shell and d. metal frame that holds the inner shell. The outer shell is bivalved and provided with hinges on one side and locking system on the other side by means of bolts which facilitate the opening of the valves after the formation of every sludge pot. The outer shell is also

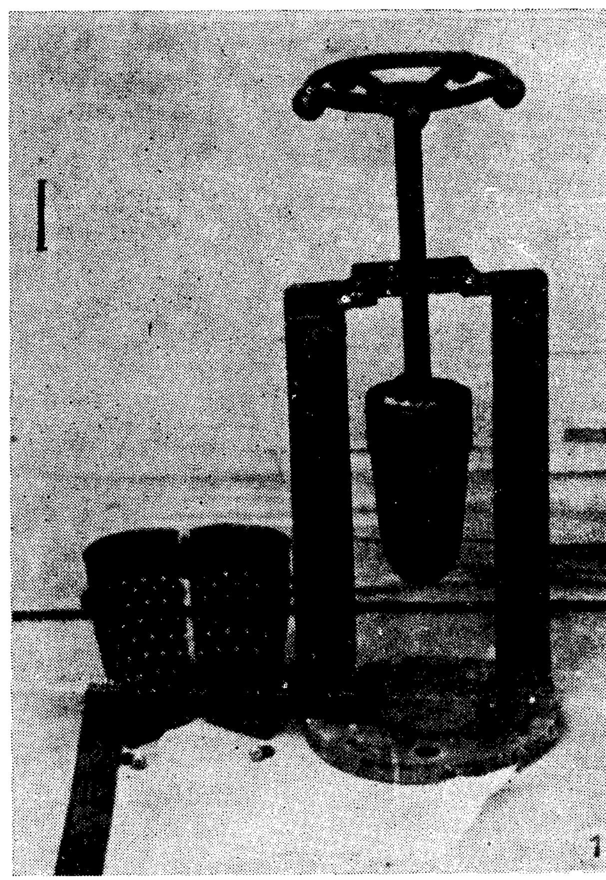

Fig. 1—Components of the Mould for making sludge pots.

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provided with holes. Inside of the outer shell is lined with detachable nylon wire mesh which do not allow the fibres and the debris to escape through it. The inner shell of the mould is solid metal which can be lowered or elevated in the frame by screw type mechanism. The outer shell is filled with 500 ml of sludge with 6% to 7% consistancy. Then the inner shell is slowly driven into the outer shell of the mould which applies even pressure on the sludge to form the pot by draining the excess water through the nylon mesh and outer shell pores. The inner shell is carefully removed and the outer shell opened up to obtain the wet sludge pot. The wet sludge pot has about 80% moisture content which is either sun dried or oven dried. The dried pots have broad open top and slightly narrow base. The pot is 10 cm high and has 2 mm wall thickness (Figure. 2). The pots are filled with soil and farmyard manure in 4:1 ratio, watered and the seed of *Eucalyptus grandis* seeds were directly dibbled[1] in the pots. The pots with eight week old seedlings were directly outplanted without removing the sludge pots. After one month of outplanting, a few seedlings were dug out to evaluate the spreading of roots.

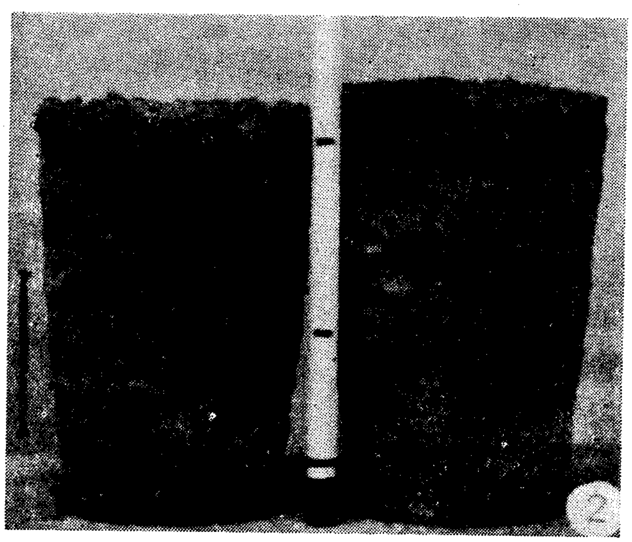

Fig. 2—Sludge pot after drying.

RESULTS AND DISCUSSION :

The effluent sludge is mainly composed of fibres which amount to about 75% to 85%. The rest is inorganic matter. The chemical composition shows variation depending upon the inputs. The chemical composition (range) of the sludge is furnished in Table I. The fibre

TABLE I. Chemical composition of sludge*

Chemical	Range (%)
1. Organic (Cellulose & Lignin)	75—85
2. Inorganic compounds	15—25
a. Silica	1—1.5
b. Al_2O_3	4—6
c. Calcium as CaO	12—15
d. Magnesium as MgO	0.2—0.4
e. Sodium as Na_2O	1—1.5

Source : Central Laboratory, HNL.

in the sludge contributes to the formation of the pot by webbing process. The sludge mostly contains broken fibres (fines) and their composition is in Table II.

TABLE II. Bauer and McNett fibre classification of effluent sludge*

Mesh size	% of fibres
+30	12
+50	12 5
+100	15.2
+200	9.7
—200	50.6

*Source : Central laboratory, HNL

The inorganic matter acts as filling material in the fibre web. The sludge is normally nutral and occasionally alkaline. As the alkalinity[2] gravely affects the plants growth, the pH of the sludge is to be neutralized prior to making sludge pots. When the alkaline sludge is incubated with or without sugar at room tempatature in aerobic condition the sludge with sugar responded at faster rate in bringing down the pH (Table III). When the alkaline sludge pots were used for raising seedlings, the seeds did germinate but the seedlings showed stunted growth and yellowing of the leaves. The pH of the soil was risen from 6.5 to 8.5 which is highly adverse to the plant growth, as it creates. the high alkaline stress.[2] Hence the sludge pots were made out of the neutral sludge.

TABLE III. Change of pH with lapse of time

No. Days	pH of Sample A	B	C
0	10.10	10.10	10.10
2	9.86	9.86	9.72
4	8.69	9.34	8.17
6	8.75	9.16	7.43
8	8.60	9.40	6.77
10	8.37	8.71	6.43
12	8.58	8.66	6.31
14	8.32	8.80	6.33
16	8.33	8.79	6.45
18	7.93	8.67	6.36
20	7.58	8.58	6.56

Sample A. 25 ml sludge + 50 ml water.

B. 25 ml sludge + 50 ml water (50 ml of supernatent replaced 50 ml of fresh water).

C. 25 ml sludge + 50 ml water + 500 mg sucrose.

The neutral sludge pots were kept under running water to assess its resistance to disintegration as the pots must withstand watering in the nursery stage for 3–4 months. In this experiment the pot remained intact and only became soft.

After these quality checks about fifty sludge pots were used in place of polythene bags in raising *Eucalyptus grandis* nursery. The growth of seedlings in the sludge pots were observed to be normal (Figure 3). After two months of growth the seedlings were outplanted in the field. Their growth is normal (Figures 4, 5). Then after one month of outplanting, the seedlings were dug out to evaluate the penetration of the roots through the sludge pot is due to the porous nature of the later. These *E. grandis* plants have attained an average height of 1.5 meters in the field in six months.

In another eperiment, we have taken advantage of the porocity of the sludge pot and supplied the water to the pot by keeping the pots in water tank and maintained one centimeter water level thereby avoiding the conventional watering by sprinkling method. Th:

Fig. 3—Sludge pot with two weeks old ***Eucalyptus grandis*** seedling.

Fig. 4–Four weeks old outplanted seedling of *E. grandis*

Fig. 5—Ten weeks old *E. grandis* seedling in the field.

Fig. 6—Partially dug out ten weeks old *E grandis* seedling. Note the roots (arrow-head) penetrated the sludge pot (arrow) and spreading out.

Fig. 7—Fully dug out ten week old *E. grandis* seedling with well developed root (arrow-head) system. (Scale : Unit lines in all figures indicate 5 cms.)

method ensured uniform moisture required in the pot soil and the plant growth is noted to be normal. As the budget provision for the watering in the nursery is about 1/3, replacing the polypot with sludge pot will be more economical.

The direct outplanting of the seedlings with sludge pot enable the plants to establish well, whereas the removal of the polybags prior to placing in pit is uneconomical and also the process disturbs the soil block and plant roots which are more likely to increase the failure rate. The sludge pot also has water holding capacity due to the presence of cellulosic fibres and this property improves the availability of the water in the rhizosphere and thereby percentage of establishment of the seedlings in the field.

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