

Light Weight Screw Press Machine for Removal of Bio-Digested Slurry

Jasvarinder Chalotra

Senior Research Fellow, School of Renewable Energy Engineering, College of Agricultural Engineering & Technology, Punjab Agricultural University, Ludhiana- 141004, Punjab, (India)

Abstract: The main objective of this research is to develop the light weight screw press extraction machine which can be lifted by and operated by a person individually for extraction of bio-digested slurry from the depth of 10 feet and various viscous materials i.e. cow dung, sand etc. This machine is developed for paddy straw based biogas plant. In this plant the biogas is produced by paddy straw waste husks. The plant having capacity of 16 quintal paddy straw husks with 4 quintal cow dung. It once filled the gas produced for 3 months. After 3 months the removal of bio-digested slurry is a big problem. So the extraction by screw press is considered for removal of material. This design considered lightweight materials i.e. having single phase 1H.P motor on the top of machine.

Keywords: Light Weight Screw press machine diameter 4 inch x 9 feet long (weight 22 kg), Single phase 1H.P motor, Bio-digested slurry, Dry fermentation biogas plant (10 feet x 10 feet)

1. Introduction

Energy management is the main focus area of government research centers in these days. To save the energy and reducing the utilization of non-renewable energy sources by replacing it with energy efficient techniques. In energy saving projects the role of machinery is also increasing day by day. Machinery and atomization plays a key role. Government is focusing on various renewable sources such as solar technology and biogas technology. These energy resources are the biggest solutions of problems which arise due to shortage of many energy resources. There are many sources which produce biogas and reduce the usage of LPG cylinders. The new technology of producing biogas from paddy straw waste husks is a good technology which is best solution of paddy straw waste management. In this research the machinery is totally based on the plant requirements. In developing countries, waste management has the highest share in municipalities' budgets, spending from 20% to 50% of their available budget on solid waste management [1]. Removal of rice straw is done for its use as livestock bedding and feed, fuel for cooking and other off-field purposes [2]. In this research the rice husks waste are used to produce the cooking gas. In this the 16 quintal of rice husks are used as a material mix with cow dung are used in plant for producing gas for regular period of 3 months. The machine developed is also focused on the requirement of plant. This research is valuable for peoples as well as anti-pollution. These types of techniques are adopted in these days because these are renewable sources of energy.

2. Methods & Materials

The machine was trailed on agriculture waste material i.e. bio-digested slurry (paddy straw mix cow dung). This machine was developed to remove the bio-digested slurry from the dry fermentation biogas plant. Earlier the labour was used for removal which time consuming and physical strength was required. The solution for this problem was required and automatic system for this removal was required. In this plant the waste paddy straw husks of sixteen quintal and four quintal of cow dung is filled in the

plant. Fermentation occurs and biogas starts producing from the plant for regular three months. After the time period was completed the removal becomes head ache. For this the machine was developed and trailed at Punjab agricultural university, Ludhiana. The machine was developed according to 10 feet x 10 feet drawing of plant. The machine developed in this way which can be easily operated by individual person and can be rotated in any direction of plant.

In this design of machine 9 feet of CRC pipe was used to cover the screw press. The single phase 1 H.P motor was inserted on the top for working. The weight of machine is 22 kg and is shown in fig.1.



Figure 1: light weight Screw press machine with 1 H.P motor (4inch x 9 feet long)

Machine Specifications and cost of material of developed machine:

S. no	Material used	Cost of material (Rs)	Weight (kg)
1	Screw press including labour	7000	11
2	CRC pipe	1500	6
3	1 H.P Motor	4000	5
Total		Rs 12,500	22 kg

3. Design Considerations

- 1) The material used should be of low weight, low cost and easily available.
- 2) The working length should be according to depth of biogas plant.
- 3) Wires of motor should be covered safely.
- 4) Frame should be firmly fixed on the top of pipe and welded firmly, so that weight of motor and during operating the machine assembly remains solid.
- 5) The material like paddy straw husk should be chopped well, because this is applicable only on well chopped material not on bales of paddy straw.
- 6) The joints should be welded firmly.

4. Results & Discussions

In this research the results were observed on the working of machine. During working on plant the time taken and the material removed is evaluated and data is made on these evaluations. The results observed are shown in table 2.

Table 2

S.no	Material extracted with screw press machine (kg)	Time taken for extraction of material(minutes)
1	7	15
2	8	15
3	7	15
4	9	15
5	8	15
6	9	15
7	7	15
8	6	15
9	9	15
10	8	15

In table 2 the results of output from machine obtained are shown. In this the screw press machine is operated for average time of 15 minutes and the material extracted is calculated in kgs. The trials made and results obtained are shown in table 2.

5. Conclusions

- 1) The machine is fully automatic and solution of replacement of heavy physical load.
- 2) The machine works properly and did not show any accidental chances.
- 3) This machine is a good concept and applicable only for extraction viscous materials, semi- solid material rather agricultural of industrial.
- 4) For paddy straw based biogas plant this machine is applicable on well chopped material which becomes bio-digested slurry after three months.
- 5) Machine can be operated by single person and this machine cover all corners of biogas plant.
- 6) There are many concepts for lifting the material i.e. hydraulics , conveyers but extraction by screw press and uplifting by pulley systems are the best concepts and affordable at farmer and user end.
- 7) Cheaper concept and easily transported and after using the machine the motor can be used for other works.

6. Future Scope

- 1) This concept of design and machine can be used on various materials for lifting and extracting i.e. cow dung, sand etc.
- 2) The capacity of machine is increased by increasing diameter and length.
- 3) This machine is used for extraction of oil also.

References

- [1] N.Scarlat^a, V.Motola^{a b 1}, J.F.Dallemend^{a b 1} "Evaluation of energy potential of Municipal solid waste from African urban area" Renewable and Sustainable Energy reviews" vol 50, October 2015, Pages 1269-1286.
- [2] Chang CH, Liu CC, Tseng PY.2013" Emissions inventory for rice straw open burning in Taiwan based on burned area classification and mapping using Formosat-2 imagery". Aerosol Air Qual Res. 13:474-87 Hibberd JM, Sheedy JE and Langdale JA, Using C4 photosynthesis to increase the yield of rice-rationale and feasibility. Curr Opin Plant Biol11(2):228 –231 (20 08
- [3] Abubakar, S.Z. and Y.D. Yiljep. 1996. "Design and development of a groundnut Kneader". Proceeding of the Nigerian Society of Agricultural Engineers (NSAE). Vol. 18 pp 245-250.
- [4] Engling G, Lee J, Tsai Y.2009. "Size-resolved anhydrosugar composition in smoke aerosol from controlled field burning of rice straw ". Aerosol Sci.Tech.43(7):662-672. Doi:10.1080/02786820902825113
- [5] AREMU, A. K1 and OGUNLADE, C. A2 "Development and Performance Evaluation of an Extractor for Removing Oil from Soaked KenafBast and Core International Journal of Advanced Research (2013), Volume 1, Issue 4, 196-201
- [6] Owolarafe O. K., Faborode M. O., &Ajibola O. O. "Comparative evaluation of the digester-screw press and hand-operated hydraulic press for oil palm fruit processing", Journal of Food Engineering, U. K., Vol. 52, PP. 249–255, 2002.

Author Profile



(India)

Jasvarinder Chalotra is Senior Research Fellow, School of Renewable Energy Engineering, College of Agricultural Engineering & Technology, Punjab Agricultural University, Ludhiana- 141004, Punjab,