DESIGN AND DEVELOPMENT OF LOW COST POST HARVEST EQUIPMENTS FOR JATROPHA

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by

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Dedicated to.....

my father who instilled in me the value of education,

my mother whose unending love and sacrifices inspired and encouraged me,

my wife and son who supported me in this endeavor and

the Almighty who blessed me with the ability and strength to accomplish it.

CERTIFICATE

This is to certify that the thesis entitled, **"DESIGN AND DEVELOPMENT OF LOW COST POST HARVEST EQUIPMENTS FOR JATROPHA"** being submitted by **Mr. Rama Chandra Pradhan** to the Indian Institute of Technology, Delhi for the award of Doctor of Philosophy is a record of bonafide research work carried out by him under our guidance and supervision in conformity with the rules and regulations of Indian Institute of Technology, Delhi.

The research report and results presented in this thesis have not been submitted, in part or in full, to any other university or institute for the award of any degree or diploma.

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(Rama Chandra Pradhan)

ABSTRACT

Promoting biofuel as a partial substitute for the fossile fuel is a prudent approach followed by several countries. Developed countries use edible oils like rape, soya, snowflower, etc for production of biodiesel. Developing countries have opted for cultivating non-edible oilseeds like Jatropha, karanja, etc on non agricultural waste lands for employment generation and reclamation of waste lands to production land. Government of India has created a "Biofuel Mission" and identified Jatropha curcas as a potential source of oil among other non-edible oilseeds. The mission had proposed an area of 11 million ha under Jatropha cultivation by 2012. Post harvest operation, plays an important role to increase production and oil production by reducing the post-production losses. An important part of production technology of vegetable oil is decortication and expression of oil from seed. The main focus of the thesis was to develope efficient post harvest equipments like decorticator and efficient oil expeller for Jatropha.

To characterize the sample properties affecting the post harvest processing of Jatropha, various physical properties of fruit and seed were evaluated. The physical properties such as size, shape, densities, weight, surface area, angle of repose and static coefficient of friction were determined. Such basic information was essential for designing and fabricating the equipment for Jatropha.

Jatropha fruit, presently dehulled manually in the absence of a suitable mechanical device and manual decortication is time consuming and tedious operation. A small, continuous, hand-operated machine, specially designed and constructed for decortication of Jatropha fruits was fabricated and evaluated for performance parameters.

Experiments were also conducted to express oil from Jatropha seed mechanically using an existing screw press expeller. The effects of moisture content, heating temperature, and heating time on oil recovery were investigated.

It was found that the existing screw press oil expeller expression efficiency for Jatropha seeds is poor and maximum of 73%. Hence, an extruder type screw press oil expeller (15 kg/h) consisted of a casing, screw, barrel, check nut and cake outlet nut was designed and developed. The oil recovery of about 81% was achieved at seed's initial moisture content (7.22%, d.b.). As there is no addition of water (conditioning of seed, as in the case of existing oil expeller for better oil recovery), the extracted oil was of good quality. A comparative statement of different types of oil extraction unit has also been made. At the optimized conditions, oil obtained using the developed oil expeller was well within the limit and has better quality as compared to existing oil expeller. An economic analysis indicated that the developed post harvest equipments could profitably be used for small-scale processing of Jatropha in rural areas of India.

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