BIOMASS FROM UNDEREXPLOITED PLANTS : STUDIES ON *Adhatoda vasica* Nees & *Ipomoea fistulosa* Mart ex Choicy

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DOCTOR OF PHILOSOPHY

By

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CERTIFICATE

This is to certify that the thesis entitled 'Biomass from Underexploited Plants : Studies on *Adhatoda vasica* Nees and *Ipomoea fistulosa* Mart ex Choicy' submitted by Mr. Arvind Singh has been prepared under our 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 for any degree in any other University/ Institution.

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To

Maa & Darjee

they did everything for me

and

got so little in return.

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ABSTRACT

Although over dependence on biomass has increased over the time, the tendency to use selected conventional crops and plants for cultivation has left a large number of plant species un or underexploited. Today with the limitations on land availability, it has become important to consider plants, including weeds, inhabiting marginal and unproductive wastelands. Utilization of biomass as a whole, so that every part of it is fully used for satisfying the major needs of food, fuel, fertilizer etc., must be given special attention. Environmental issues associated with production and utilization of such nonconventional sources of biomass should also be taken into account. Inview of this, studies were taken up on two such plants, Adhatoda vasica Nees. of family Acanthaceae and Ipomoea fistulosa Mart ex Choicy of family Convolvulaceae, for the present thesis.

Both the plants were found to be hardy, able to sustain and multiply under adverse agroclimatic conditions, with quick regeneration potentials and easily propagated through cuttings. Biomass yield potentials upto 100 tonnes hectare^{-1} were observed for naturally growing shrubs. Growth periods for reaching the optimal height for first coppicing were estimated. Three cuttings each year yielded almost double the biomass as compared to plants not coppiced. Aerial biomass estimation was done based on linear regressions and fairly accurate estimates could be obtained by using these equations. By analysing soil samples around well established plants, it was seen that the plants tend to stabilize

pH, EC, ESP of the soil and augment its nutrient value. Macro and micro(elemental), proximate and ultimate analyses were done to get a data base for selecting utilization alternatives. Thermogravimetric and differential scanning calorimetry were also done. The biomass was evaluated for direct combustion, thermal conversion to charcoal, biomethanation, solid state digestion, by an edible mushroom, Pleurctus sajor-caju and extraction of oxalic acid. The study has brought out the potential of these weeds for providing biomass on a renewable basis and possibility of integrating various applications of the plant components in fulfilling fuel, food, fertilizer and material needs etc.

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