

**Practical Manual**  
**on**  
**Renewable Energy & Green Technology**

AAE 235 - 2 (1+1)

B.Sc. (Hons.) Agriculture, IV semester

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2020

**College of Agriculture,**  
**Rani Lakshmi Bai Central Agricultural University**  
**Jhansi - 284003**

**Syllabus AAE 235 – 2 (1+1)**

Familiarization with renewable energy gadgets. To study biogas plants, To study gasifier, To study the production process of biodiesel, To study briquetting machine, To study the production process of bio-fuels. Familiarization with different solar energy gadgets. To study solar photovoltaic system: solar light, solar pumping, solar fencing. To study solar cooker, To study solar drying system. To study solar distillation and solar pond.

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**Session** .....

**Semester** .....

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## Experiment No. 1

**Objective: To familiarize with renewable energy gadgets.**

**Renewable Energy:** -----  
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**Various forms of renewable energy**

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## Experiment No. 2

**Objective: To study solar radiation and its measurement.**

**Nature of solar radiation:** -----  
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**Solar constant:** -----  
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**Factors affecting solar constant and extra-terrestrial radiation:**

**Distance between the earth and sun:** -----  
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**Radiation emitted by the sun:** -----  
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**Solar radiation on earth's surface**

**Beam radiation:** -----  
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**Diffused radiation:** -----

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**Extra-terrestrial radiation:** -----

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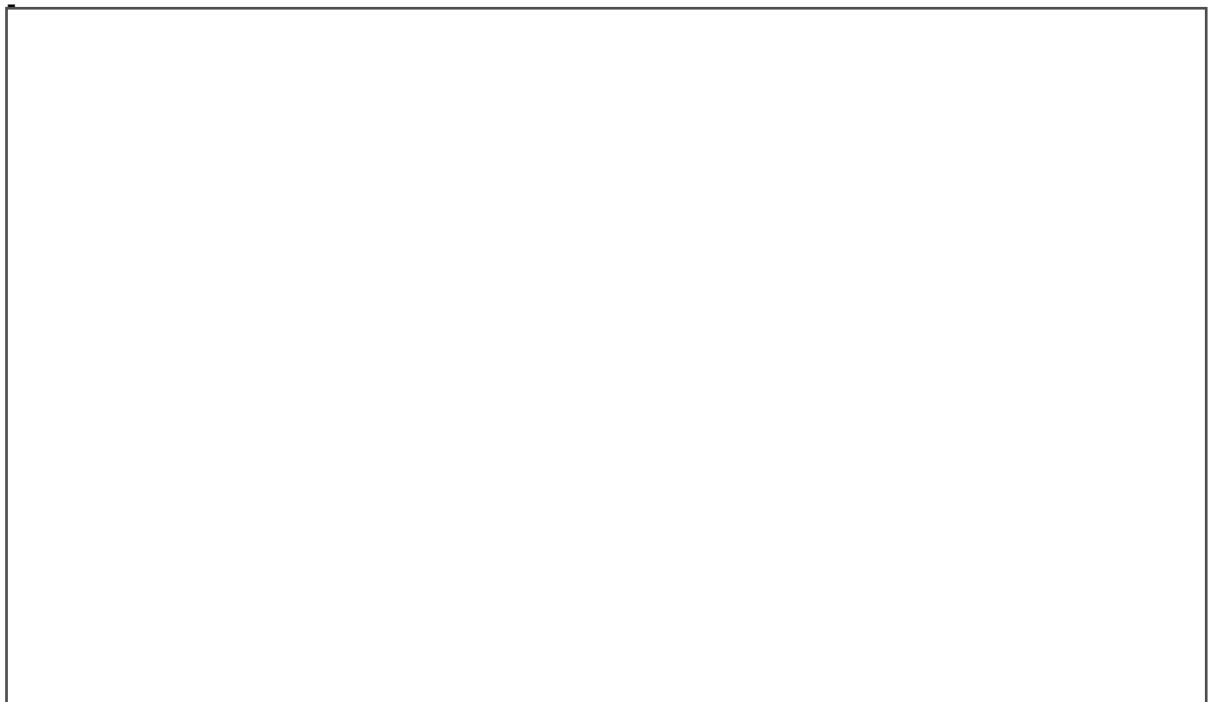
**Global or total radiation:** -----

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**Solar Radiation Measurement:**

**Pyrheliometer:** -----

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**Pyranometer:** -----

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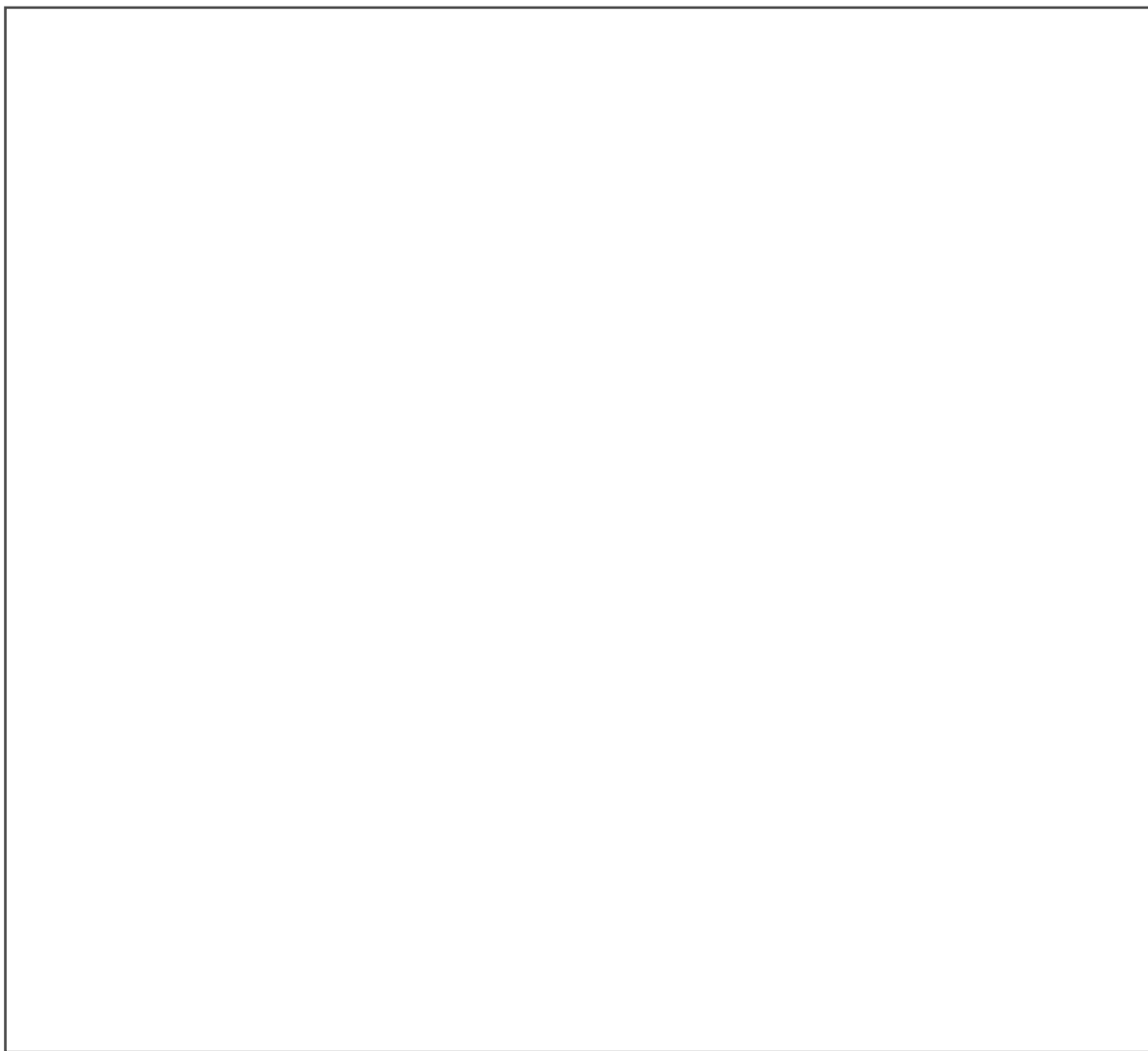
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### Experiment No. 3

**Objective:** To study working and principle of biogas plants.

**Biogas:** -----  
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**Composition of bio-gas:**

S. No.	Gas	Amount (%)

**Comparison of bio-gas with other fuels**

S. No.	Name of fuel & Unit	Calorific value (Kcal)	Mode of burning

**Biogas plants:** -----  
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**Floating gas-holder type bio-gas plant**

**Construction:** -----

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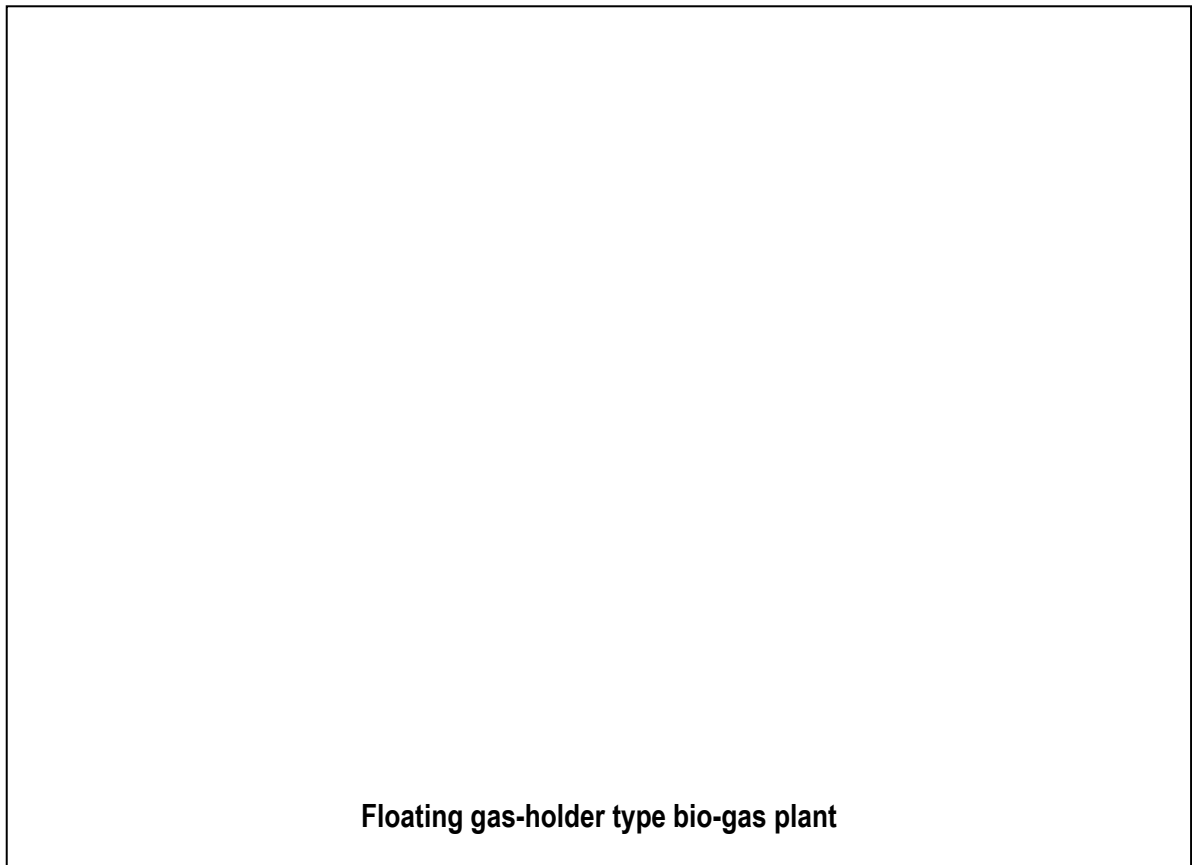
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**Working principle:** -----

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**Advantages:** -----

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**Disadvantages:** -----

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**Fixed dome (constant volume) type bio-gas plant**

**Construction:** -----

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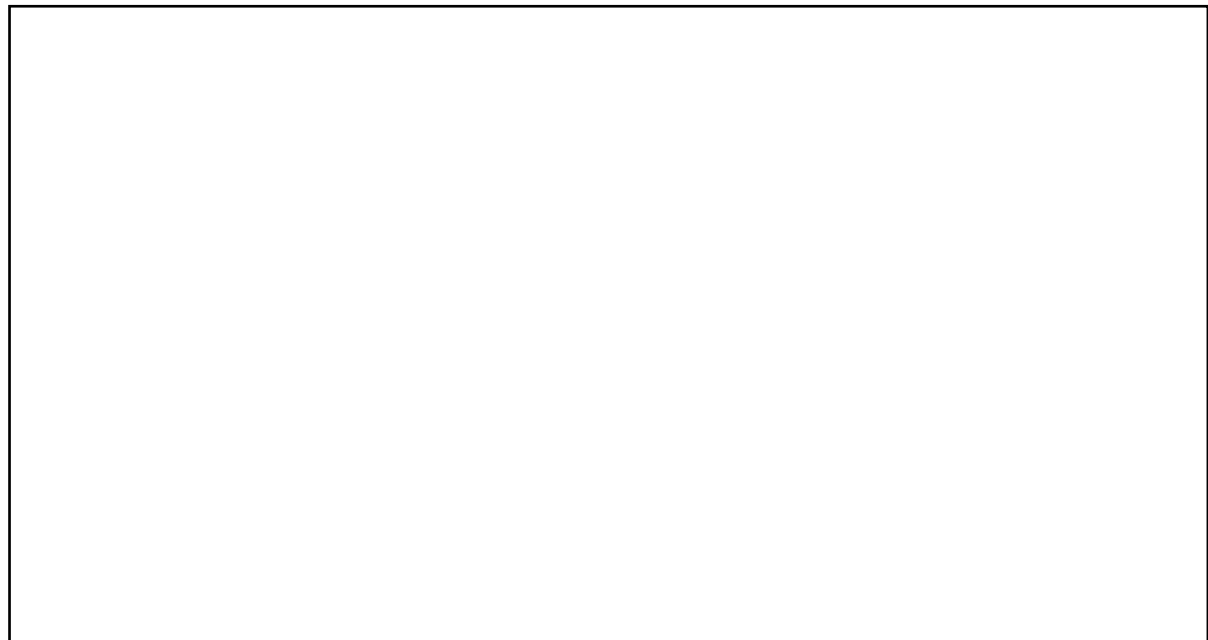
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**Working principle:** -----

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**Advantages:** -----

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**Disadvantages:** -----

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**Classification of fixed type and floating drum type bio-gas plant**

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**Deenbandhu model:** -----

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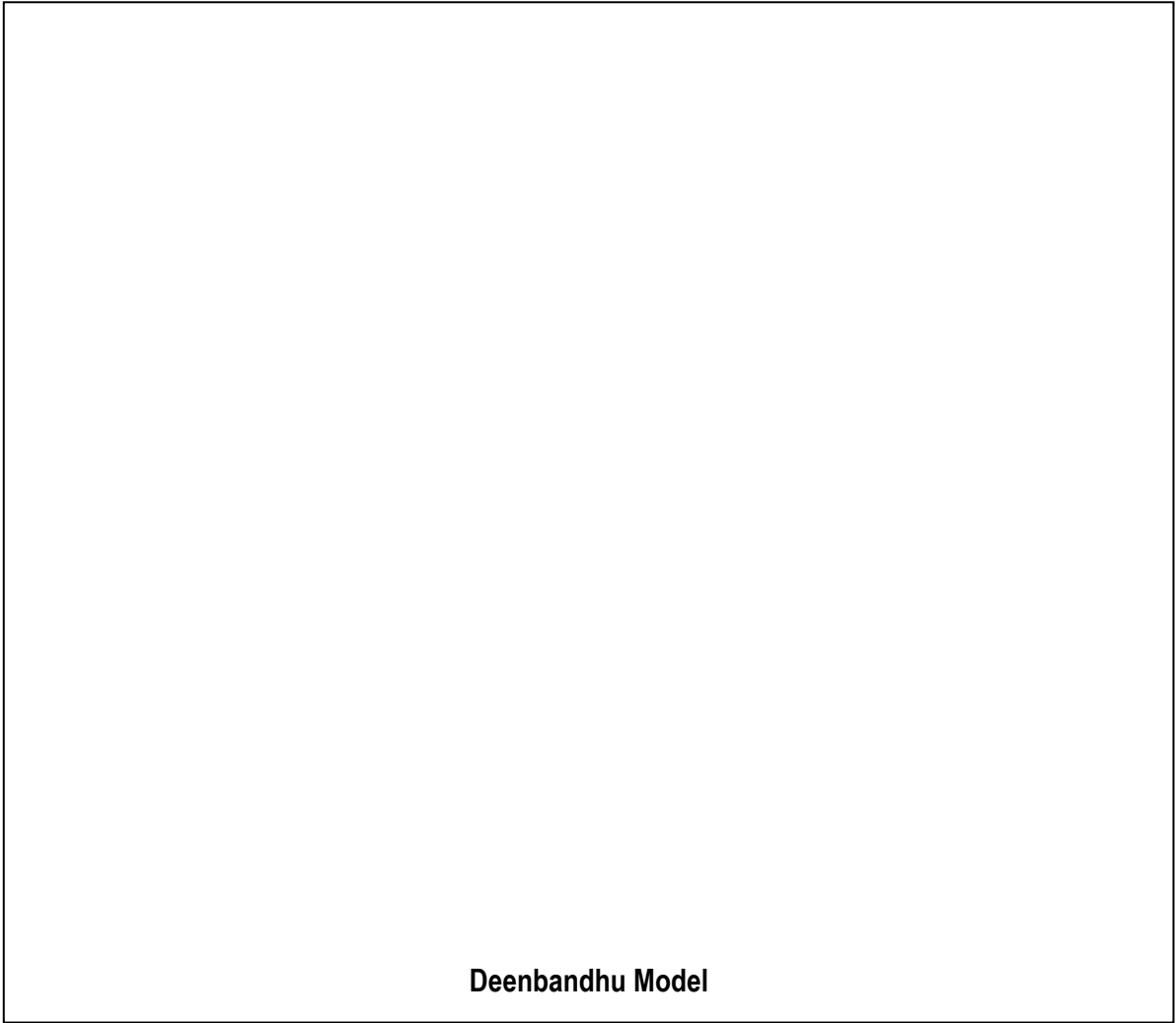
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**KVIC model:** -----

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**Drawbacks of KVIC model:** -----

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**Janta model:** -----

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**Selection of site for a bio-gas plant**

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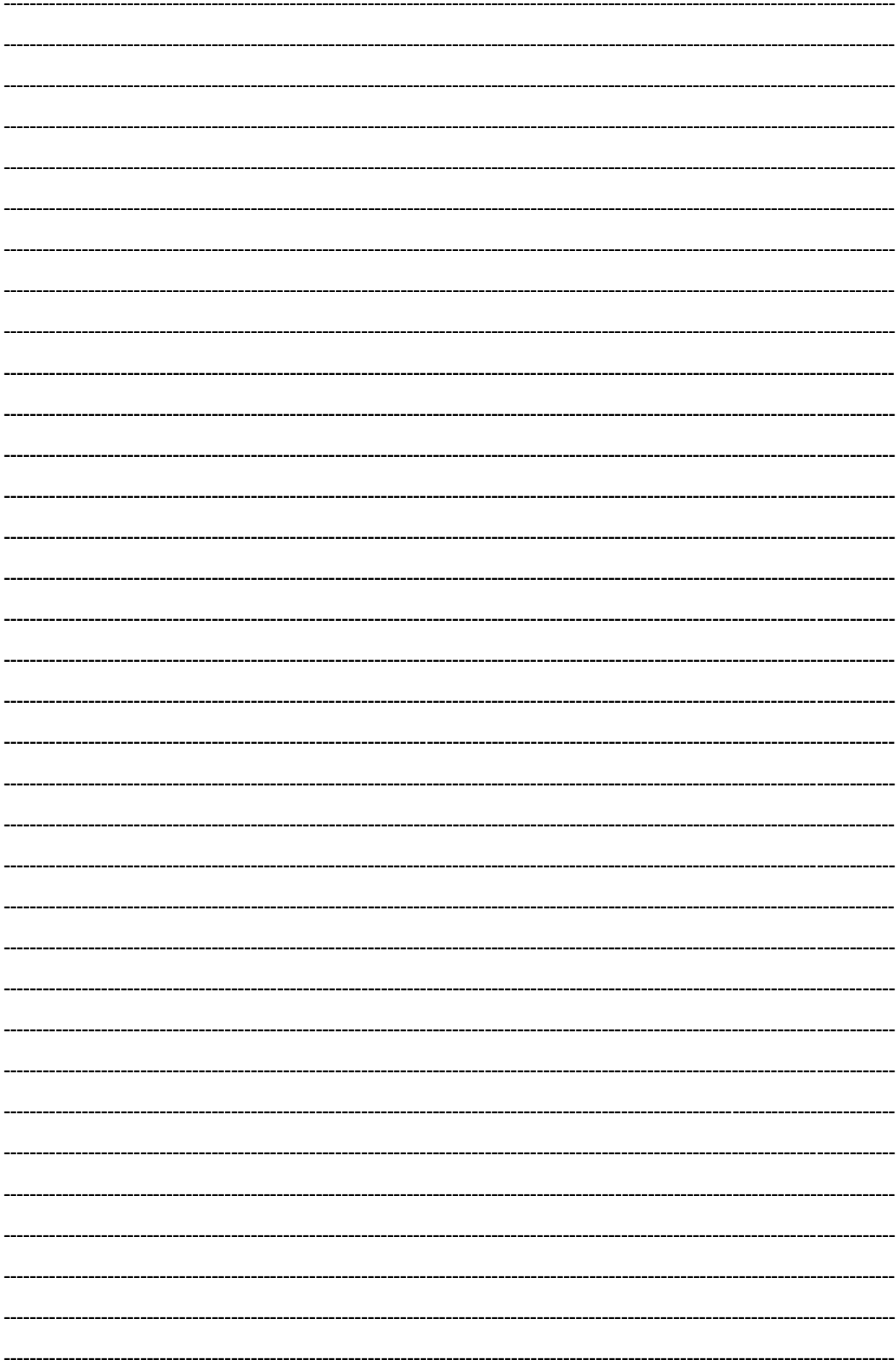
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**Fixed bed gasifiers:**

**Updraft gasifier:** -----

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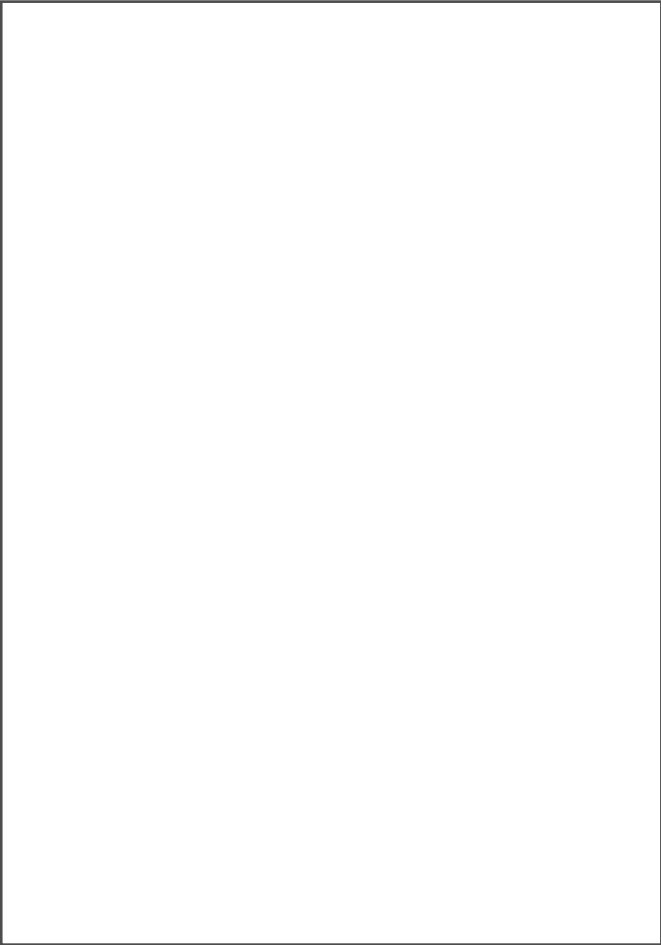
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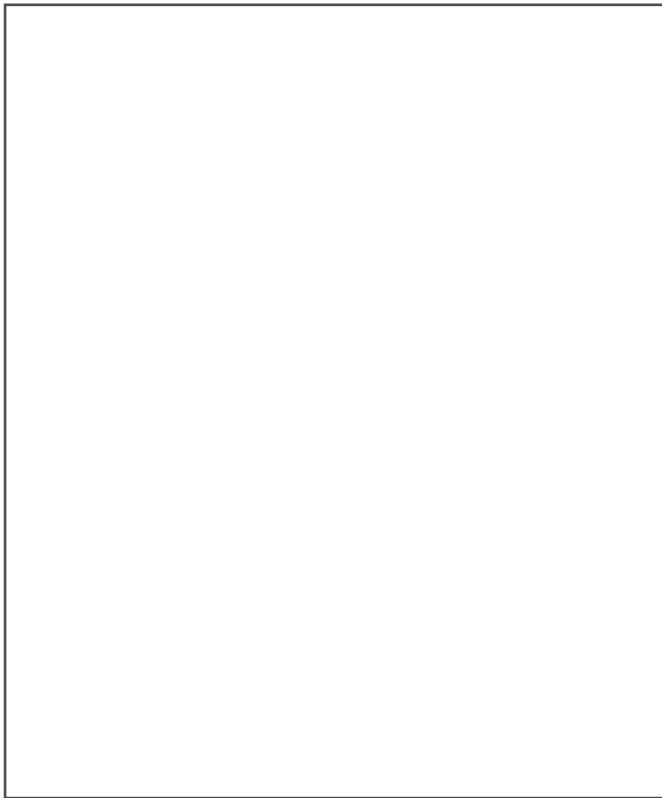
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**Downdraft gasifier:** -----



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**Cross-draft gasifier:** -----

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**Fluidised bed gasifier:** 

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**Advantages:** 

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Experiment No. 6

Objective: To study the production process of biodiesel.

Bio-diesel: -----  
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Feedstocks Used in Biodiesel Production: -----  
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Typical proportions for the chemicals used to make biodiesel are:

Reactants	Catalyst	Analyzer

Advantages of the use of biodiesel: -----  
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Disadvantages of the use of bio-diesel: -----  
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**Experiment No. 7**

**Objective: To study biomass briquetting.**

**Biomass briquetting or briquetting technology:**

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**Methods of briquetting:** -----

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**Classification of briquetting machine:** -----

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**Manually operated briquetting machine:** -----

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**Animal operated briquetting machine:** -----

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**Power operated briquetting machine:** -----

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**Piston-ram press type:** -----

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**Screw-press type:** -----

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**Pellet-press type:** -----

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## Experiment No. 8

**Objective: To study production process of bio-fuels.**

**Bio-fuel:** -----  
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**Production of Ethanol:** -----  
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**Concentrated Acid Hydrolysis Process:** -----  
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**Dilute Acid Hydrolysis Process:** -----  
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**Enzymatic Hydrolysis:** -----  
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**Wet Milling Processes:** -----

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**Dry Milling Process:** -----

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**Sugar Fermentation Process:** -----

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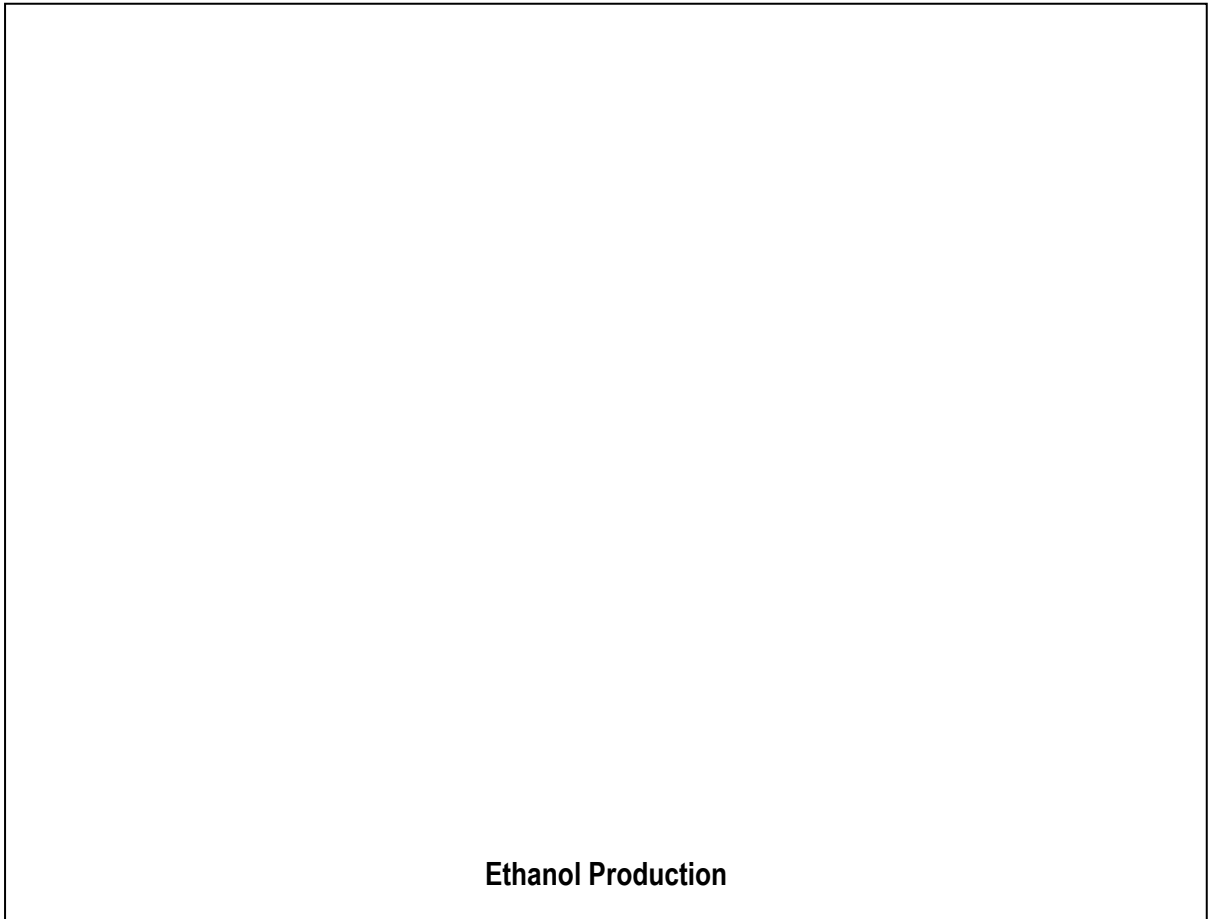
**Fractional Distillation/Separation Process:** -----

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## Experiment No. 9

**Objective:** To familiarize with different solar energy gadgets.

**Solar energy:** -----  
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**Solar energy gadgets:**

**Solar water heater:** -----  
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**Space heating:** -----  
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**Space cooling:** -----  
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**Solar distillation:** -----

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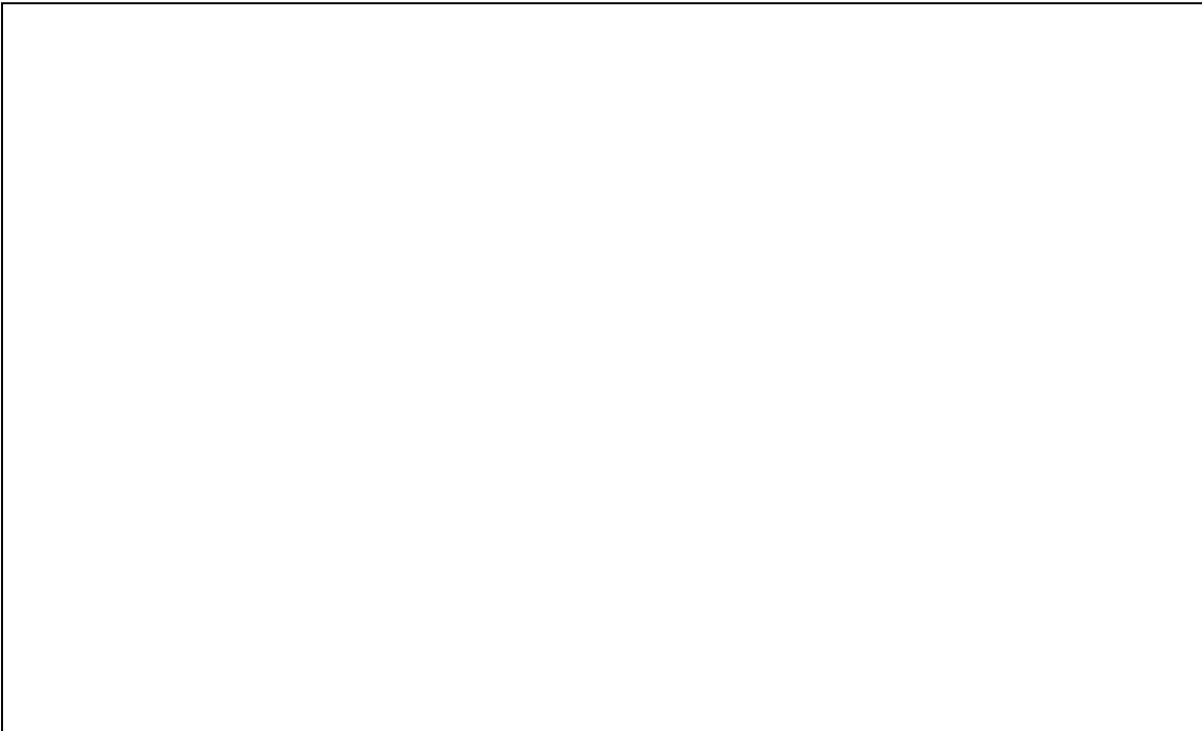
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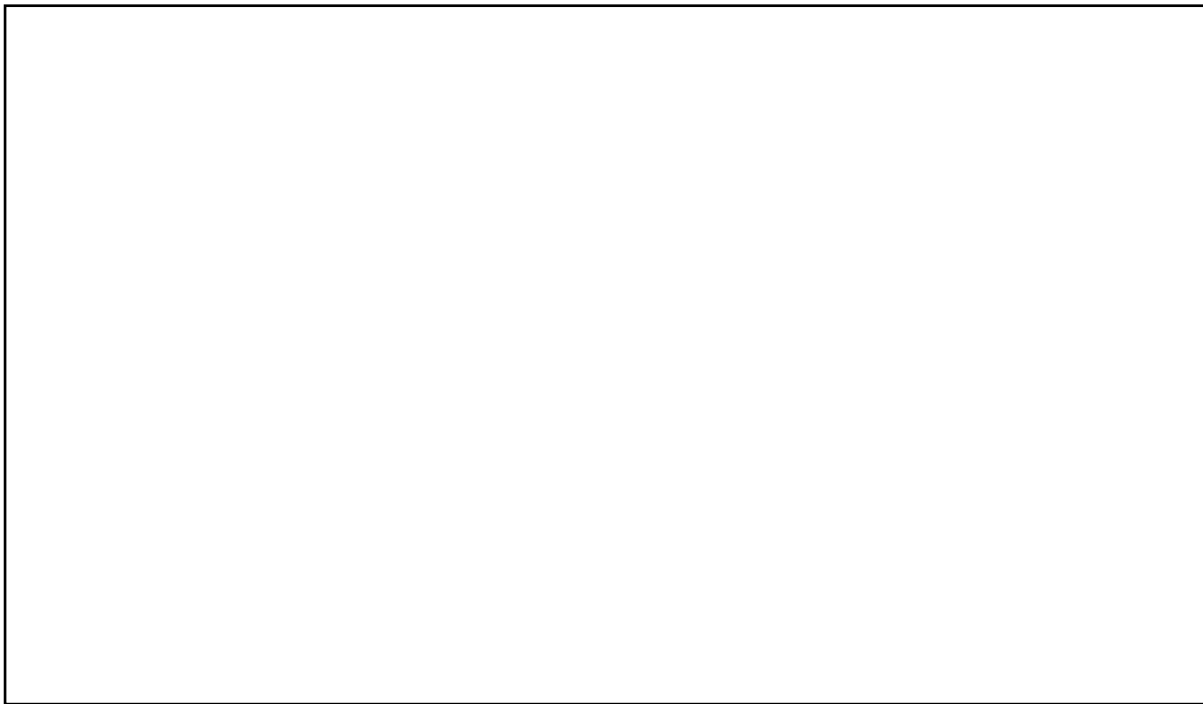
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**Solar pumping:** -----

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**Solar pond:** -----

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**Experiment No. 11**

**Objective:** To study principle and working of solar cooker.

**Solar cooking:** -----  
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**Designs of solar cooker:**

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**Box type solar cooker:**

**Principle:** -----  
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**Working:** -----  
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**Details of a box type solar cooker**

**Advantages of solar cooker:** -----

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**Limitations of solar cooker:** -----

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**Experiment No. 14**

**Objective: To study working of solar power fencing.**

**Solar power fencing technology: -----**

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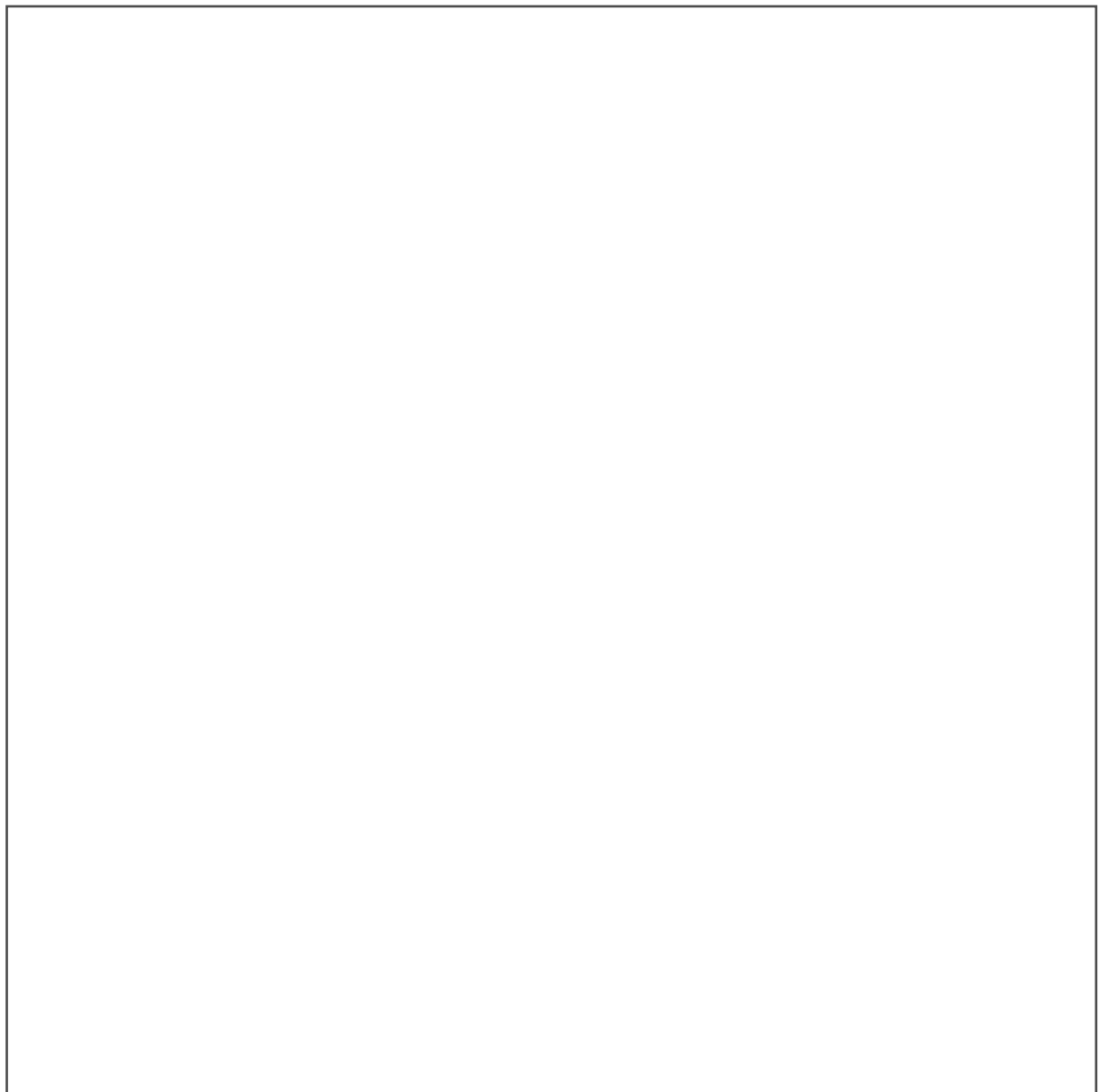
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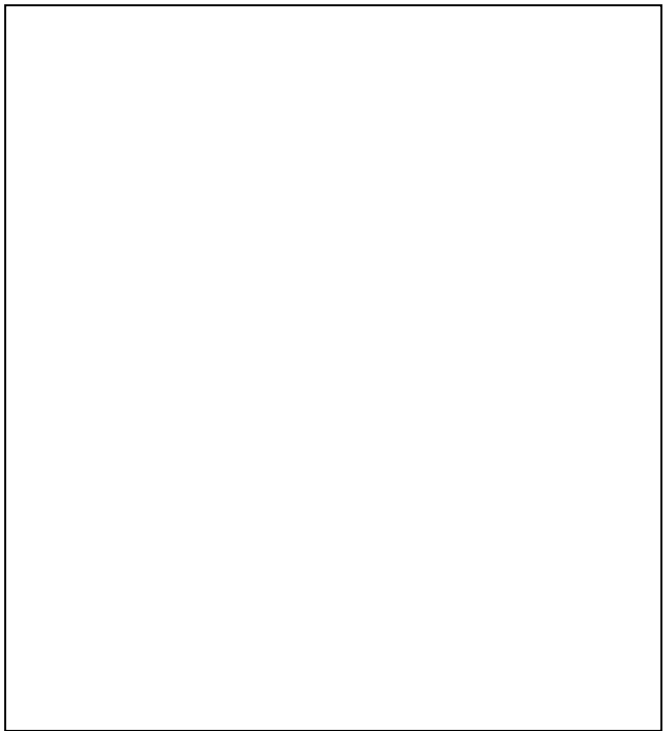
**Experiment No. 15**

**Objective: To study solar energy and its use in solar drying system.**

**Solar energy:** -----  
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**Solar dryer:** -----  
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**Cabinet type solar dryer:** -----  
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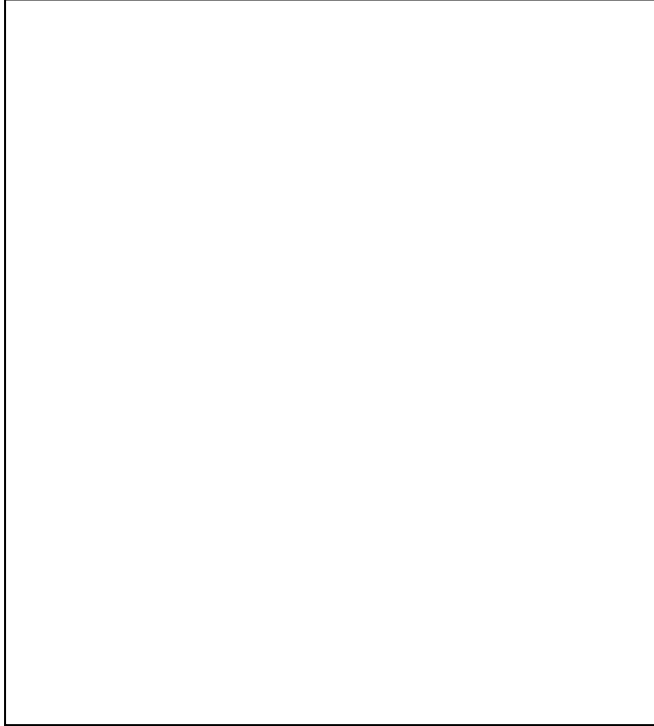


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**Suitability:** -----

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**Convection type dryer:** -----



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**Suitability:** -----

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**Advantages:** -----

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**Limitations of solar dryer:** -----

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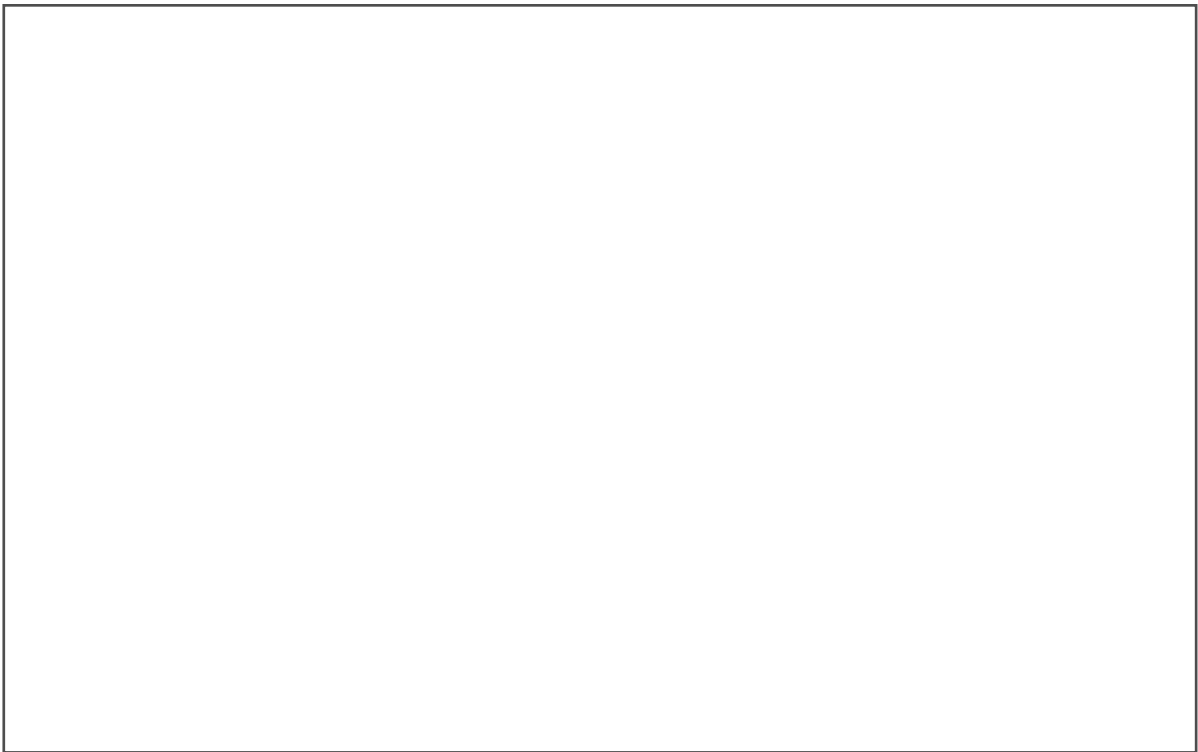
**Experiment No. 16**

**Objective: To study the importance of solar distillation system in arid, semi-arid and coastal areas.**

**Solar distillation:** -----

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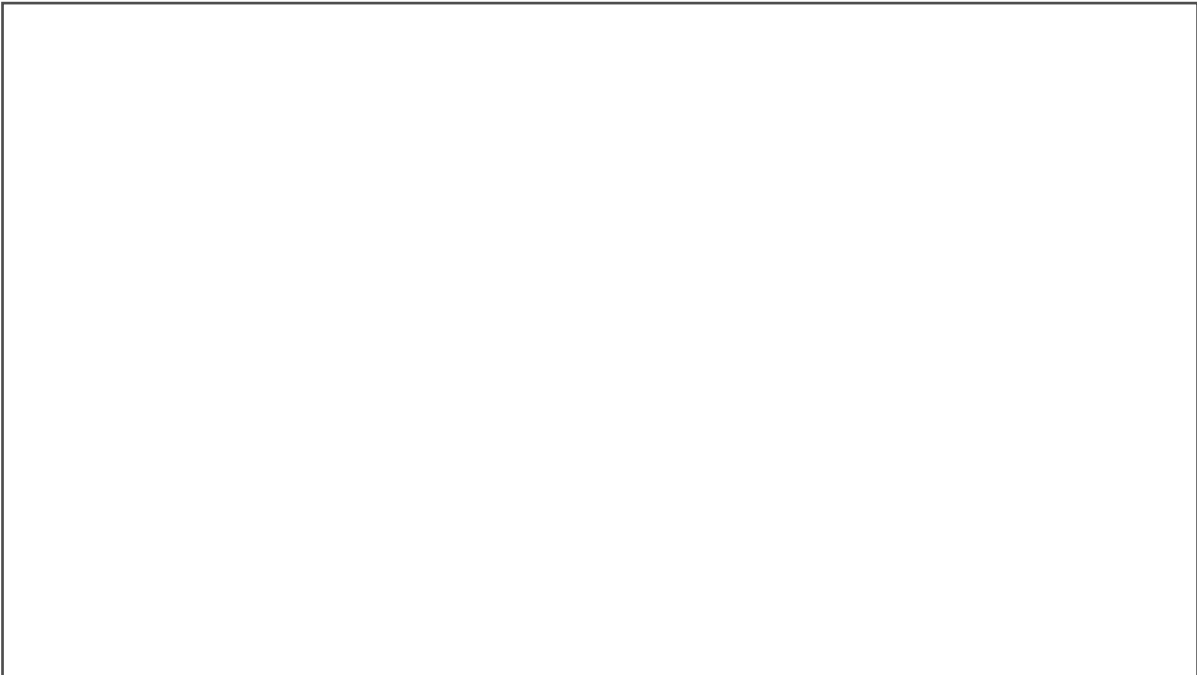


**Experiment No. 17**

**Objective: To study solar pond used for collecting and absorbing solar radiation energy.**

**Solar Pond:** -----  
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**Principle and operation and description of non-convective solar pond:** -----  
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**Zones of Solar Pond: :** -----

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**Characteristics of salt for creating density gradient in solar pond:** -----

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**Applications of solar pond:**

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**Objective: To study wind energy conversion system.**

Wind energy: -----  
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**Basic principles of wind energy conversion:**

The Nature of the wind: -----  
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The Power in the wind: -----  
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**Forces on the blades and thrust on turbines:** -----

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**Dependence of wind rotor power on wind speed and rotor diameter**

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**Applications and limitations of wind energy:** -----

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**Advantages and disadvantages of wind energy:** -----

## Appendix

**Solar constant:** It is the rate at which energy is received from the sun on unit area perpendicular to direction of the sun at a mean distance of the earth from the sun. It is mathematically expressed as-

$$= I_{sc} \left[ 1 + 0.033 \cos \frac{360n}{365} \right]; \text{ Wm}^{-2}$$

Where  $n$  = No. of days counted from 1<sup>st</sup> January

$I_{sc}$  = Solar constant

**Average value of excreta:**

Cows	10 kg per day
Oxes	12 kg per day
Buffalo	15 kg per day
Calves	5 kg per day
Horses	10 kg per day
Goat/Sheep	5 kg per day
Pigs	2 kg per day
Chicken	0.18 kg per day
Human excreta per person	0.40 kg per day

- ❖ Gas required for cooking/person/day = 0.227 m<sup>3</sup>
- ❖ Gas required for lighting 100 C.P. lamp per hour = 0.126 m<sup>3</sup>

**Fuel properties of bio-gas**

Composition	% Volume
Methane	50-60
Carbon dioxide	30-45
Hydrogen	5-10
Nitrogen	0.5-0.7
Hydrogen sulphide and oxygen	Traces