

## Progress in hybrid greenhouse solar dryer (HGSD): A review

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**Abstract.** The world population reaches to about 7.7 billion in 2018 from 6.2 billion in 2000. This much growth in population results in increased energy demand and increased food supply. As the conventional energy sources are limited. These may deplete soon if consumed at this rate. So, the world is switching towards the utilization of non-conventional sources of energy. Energy from sun is the best method as it can not only solve the energy issue but also helps in meeting food demand by conserving it. Greenhouses are made for the purpose of food conservation. Various types of solar dryers are developed by researchers till now and still the effort is being putted to make them more efficient. Hybrid greenhouse is also effort toward utilization of solar energy in more efficient way. The paper presents the heat and mass transfer analysis of hybrid greenhouse solar dryer developed by different researchers till now. The review helps the researcher in understanding the heat and mass transfer taking place inside the hybrid greenhouse and how it can be further improved.

**Keywords:** hybrid; greenhouse; solar dryer; dryer development; dryer

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### 1. Introduction

Need of food is one of the basic need of human being. With the increase in population, the food requirement also increases. The food requirement can be met either by growing more food or by conserving the produced one. The edible items (fruits, vegetables, cereals etc.) mostly get spoiled due to high moisture content in them.

The effective method to preserve the crop from being deteriorated is drying them upto a safe moisture level (Koyuncu *et al.* 2007). Solar drying is considered as the efficient method of using solar insolation (Selvanayaki and Sampath Kumar 2017, Chauhan *et al.* 2015, Janjai *et al.* 2007). Solar drying of crop prevents crop deterioration and helps in storing it for longer time (Fudholi *et al.* 2016). The dried produce has various advantages like better quality, low after harvest losses and longer storage time. The energy from the sun is clean source of energy and available in ample quantity (Kumar and Tiwari 2007). In comparison to available conventional sources, the solar

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