Introduction
High energy prices, unstable and uncertain petroleum resources, concerns about global warming and issues on national security have led to a resurgence in the development of alternative energy sources that can displace fossil transportation fuel (Alper and Stephanopoulos, 2009; Gupta et al., 2009). The alternative transportation fuels that are currently been investigated include biodiesel, bio-alcohols, biohydrogen and synthetic petroleum hydrocarbons (Alper and Stephanopoulos, 2009). Among them, the biofuel that is expected to be most widely used around the globe is ethanol. Ethanol as biofuel has several advantages such as low toxicity, biodegradable nature, safer alternative to methyl tertiary butyl ether (MTBE), generate fewer air-borne pollutants than petroleum fuel and have easy integration in the existing vehicle. Ethanol in vehicles can be either blended with the gasoline as a fuel extender and octane enhancing agent or can be used as a neat fuel in internal combustion engines (McCarthy and Tiemann, 1998). Currently most biofuel in the form of ethanol is derived from starch or sugars, however the continuous use of these feedstocks will cause food versus fuel competition.

Lignocellulosic biomass represents an abundant carbon-neutral renewable resource for the production of bioethanol (Ragusas et al., 2006). Lignocelluloses are mainly comprised of cellulose, hemicellulose, and lignin (Kuhad et al., 1997) and have evolved complex structural and chemical mechanisms for resisting assault on its structural sugars from the microbial and/or chemical degradation (Himmel et al., 2007). Several technologies have been developed during the last 80 years that allows this conversion process to occur, however, the bioconversion process is mainly consist of 3 major steps i.e., pretreatment, hydrolysis, and fermentation. The purpose of the pretreatment is to remove lignin and hemicellulose fraction, reduce cellulose crystallinity and increase the porosity of the materials. The pretreated material is subjected to the enzymatic hydrolysis and the resultant hydrolysates are fermented to ethanol using fermenting microbes (Kuhad et al., 2011a). Thermochemical hydrolysis has long been recognized as an efficient pretreatment for removing the hemicellulosic and lignin fraction from the lignocellulosic substrate to enhance its biological conversion to sugars and
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subsequently ethanol. However, the chemical harshness and higher temperature resulted in generation of toxic byproducts such as furfural, hydroxymethyl furfural (HMF) and phenolics, which significantly affect microbial cell metabolism during fermentation (Palmqvist and Hahn-Hägerdal, 2000; Chandel et al., 2007). Therefore, to make the hydrolysates amenable to fermenting microbes, detoxification of acid hydrolysate is required (Palmqvist and Hahn-Hägerdal, 2000; Saha et al 2005; Chandel et al., 2007; Gupta et al., 2009; Kuhad et al., 2011a, Gupta et al., 2011). In literature various physical, chemical and biological detoxification methods are described, but a cost-effective detoxification strategy is still to be worked out.

The pretreated cellulose-rich biomass is then hydrolysed with a consortia of cellulolytic enzymes i.e., endocellulase, exocellulase and β-glucosidase. These enzymes act synergistically and hydrolysed the cellulosic polymer to simple sugars (glucose) (Zhang et al., 2006; Kuhad et al., 2011a). Enzymatic hydrolysis has demonstrated better results for the subsequent fermentation because no degradation components of glucose are formed, however, the process is slower and costlier (Sanchez and Cardona, 2008). Various improvements have been investigated in last more than three decades that would lower the effective enzyme cost, including enzyme reusage, higher enzyme production or using genetic engineered systems (Zhang et al., 2006; Kuhad et al., 2011a); but still there is an urge to search for more competent solutions.

Since the structural sugars of lignocellulose contain both hexose and pentose sugar, the efficient fermentation of both the sugars has become a pre-requisite for the cost effective production of bioethanol. A variety of microorganisms are known to ferment hexose sugars, but the microbes for pentose fermentation are in scanty. The most common microbes for pentose fermentation are Candida shehatae, Pichia stipitis and Pachysolen tannophilus (Abbi et al., 1996a, b; Kuhad et al., 2011a). However, none of these yeasts have been found to be very promising. Intensive efforts have been made towards utilization of all the sugars present in hydrolysates by employing both genetic manipulation as well as process improvement approaches.

Over all using biomass to produce bioethanol holds much promise for providing a renewable, indigenously produced liquid energy source that can be a viable alternative to petroleum-based fuels. However, there is a great scope of improvement in each and every step of processing including selection of feedstock, pretreatment, hydrolysis and fermentation. Keeping in view the
potential and sustainable usefulness of bioethanol and all the given facts of cellulosic ethanol production, the present investigation was aimed to produce bioethanol from a panatropical weed of subtropical origin i.e., *Prosopis juliflora*. *P. juliflora* is the common vegetation of semi-arid region of Indian subcontinent and are also among the world’s top 100 worst invasive species, which have invaded millions of hectares of grazing land globally. Production of bioethanol from these weeds not only provides the long-term sustainable solution in the form of low value feedstock but also solve the problem of weed management.

*Transportation biofuels such as cellulosic ethanol, if produced from low-input biomass grown on agriculturally marginal land or from waste biomass, could provide much greater supplies and environmental benefits than food-based biofuels.*

*Jason Hill and coworkers (2006)*