

Industrial Products : Alcohol

By

DR. PRAMOD KUMAR MAHISH

Asst. Professor & Head

Department of Biotechnology

Govt. Digvijay PG College Rajnandgaon (C. G.)

pramod.mahish@rediffmail.com

Bioreactor and Products: Stirrer tank Bioreactor

- Enzyme – cellululase , batch ahmad et al 2008
- xylose (Continuous) silva et al., 1996
- lipase Dominguez et al 2005
- Continuous – Biohydrogen Younesi et al., 2008
- Biodegradation of phenol – continous Holladay 1978
- Ethanol continous Mohammadi et al. 2012
- Citric acid Papagianni, et al. 1998 batch

Bioreactor and Products: fluidized bed reactor

- Textile waste treatment sen et al. 2003
- Autotrophic growth of anaerobic ammonium-oxidizing micro-organisms graaf et al. 1996
- Carbon nano tube Wang et al 2002

Bioreactor and Products: Photobioreactor

- Bioethanol through algal biomass
- Microalgae
- Spirulina
- Chorella

Bioreactor and Products: Packed bed bioreactor

- Biohydrogen – Rachman 1998
- Dye waste water treatment Talarposhti 2001
- Hama et al., 2007 biodisel
- Biodegradation of phenol Kim et al., 2002
- Citric acid solid state Lu et al. 1997

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Alcohol Production

Introduction

- Ethanol fermentation, also called alcoholic fermentation, is a biological process which converts sugars such as glucose, fructose, and sucrose into cellular energy, producing ethanol and carbon dioxide as a side-effect.

Organism

- *Zymomonas mobilis*
- *Saccharomyces cerevisiae*

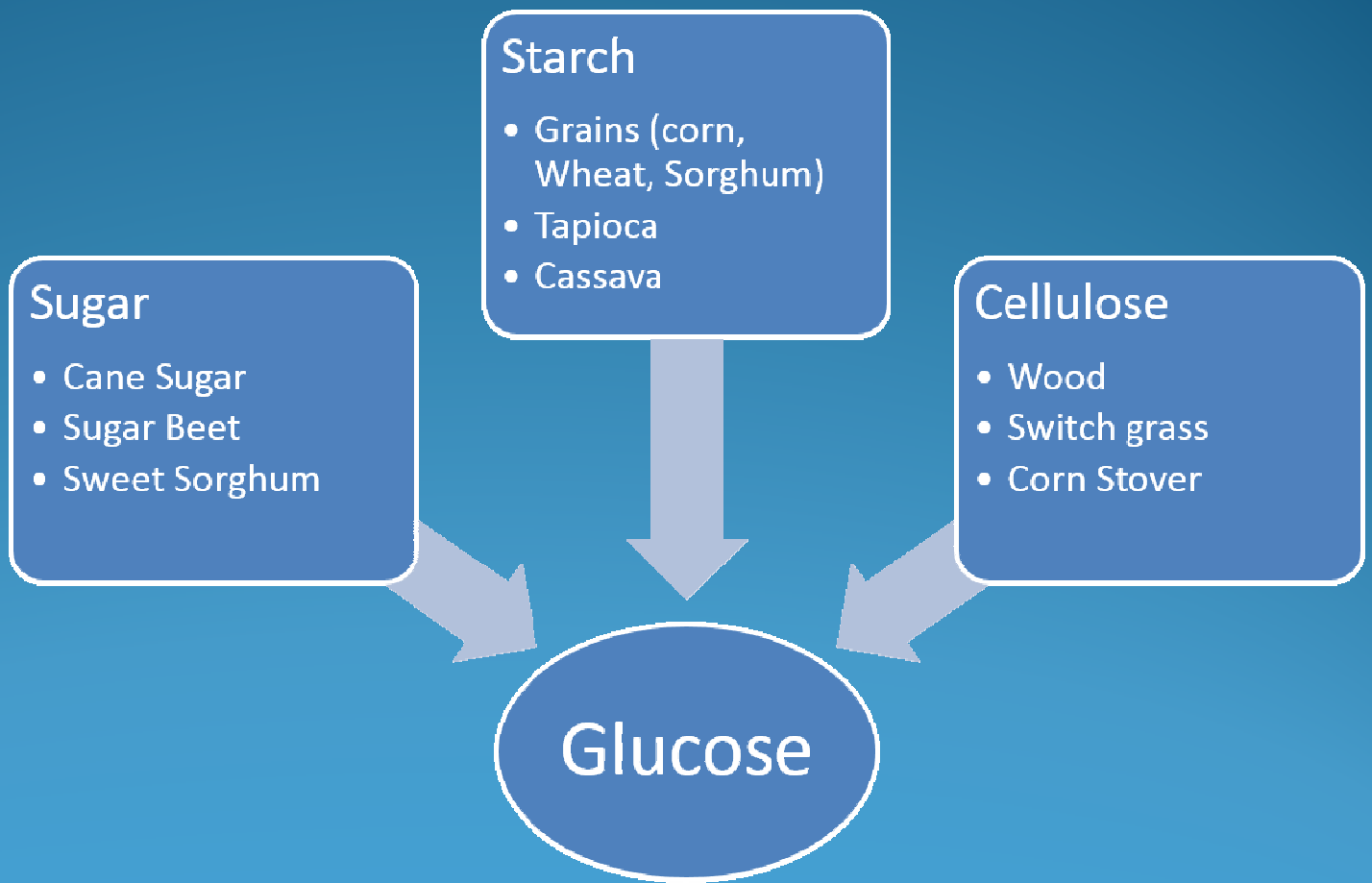
Uses of Ethanol

- as a transport fuel to replace gasoline
- as a fuel for power generation by thermal combustion
- as a fuel for fuel cells by thermochemical reaction
- as a fuel in cogeneration systems
- as a feedstock in the chemicals industry



Alcohol Production Process

Source

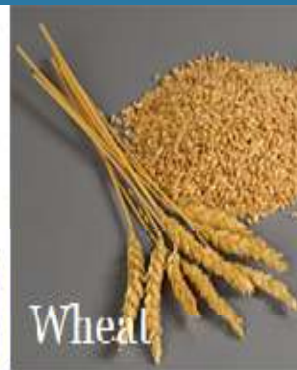




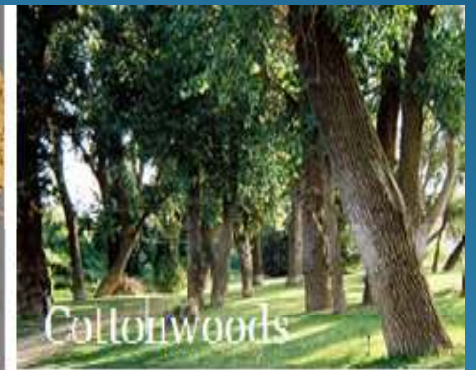
Wood chips



Switchgrass



Wheat



Cottonwoods



Corn stover



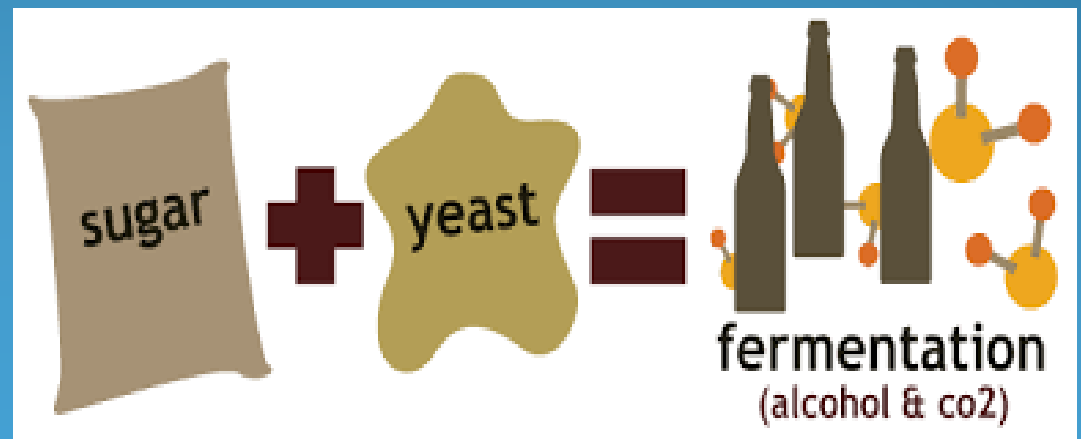
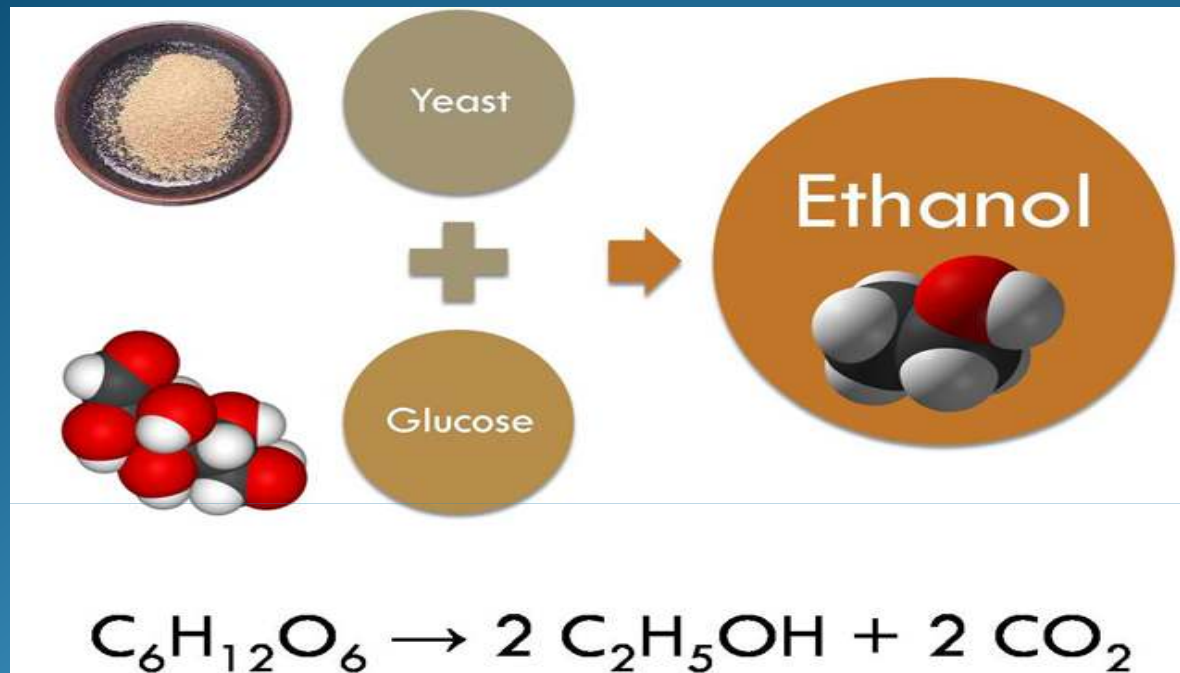
Paper



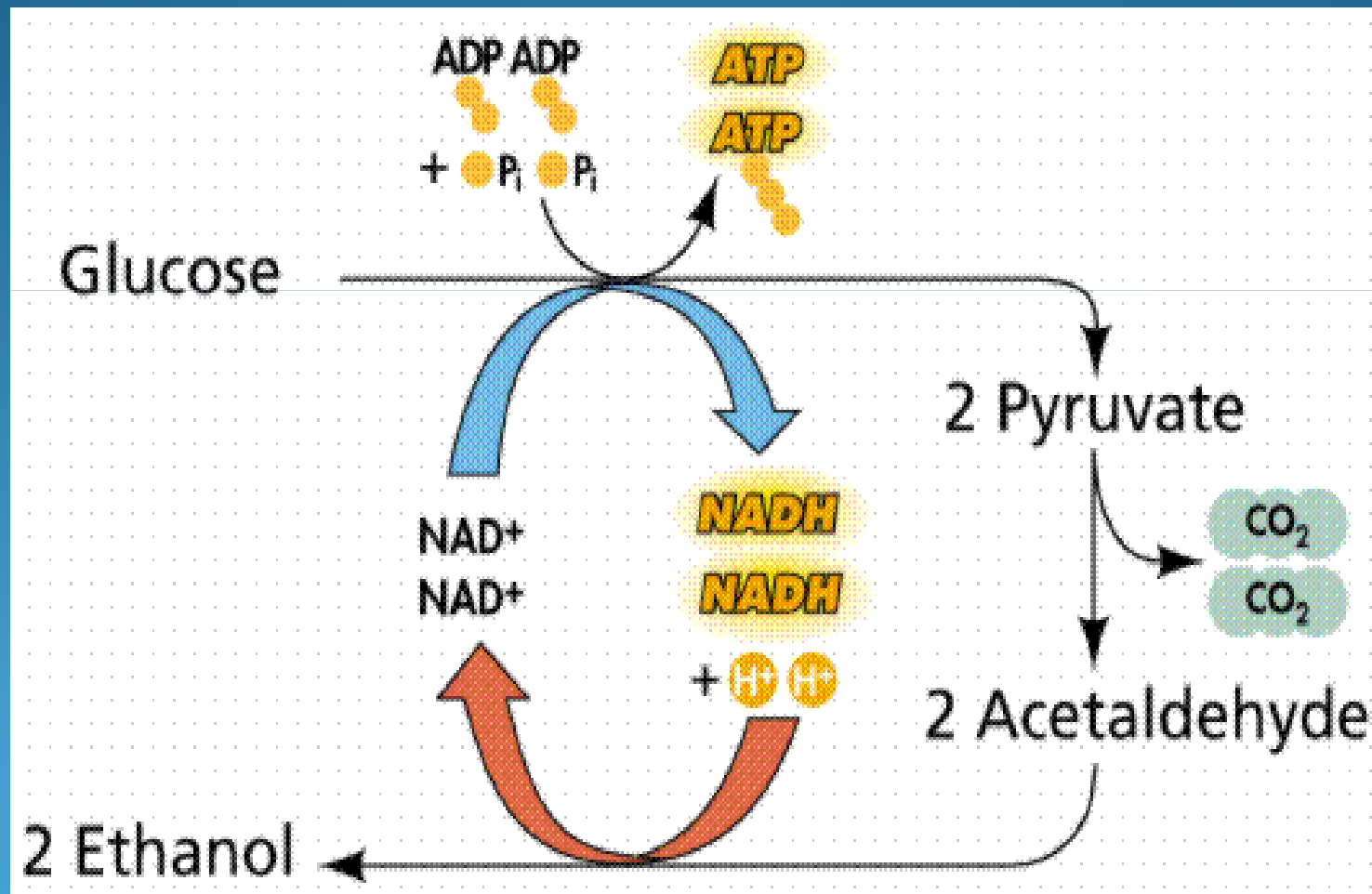
Corn



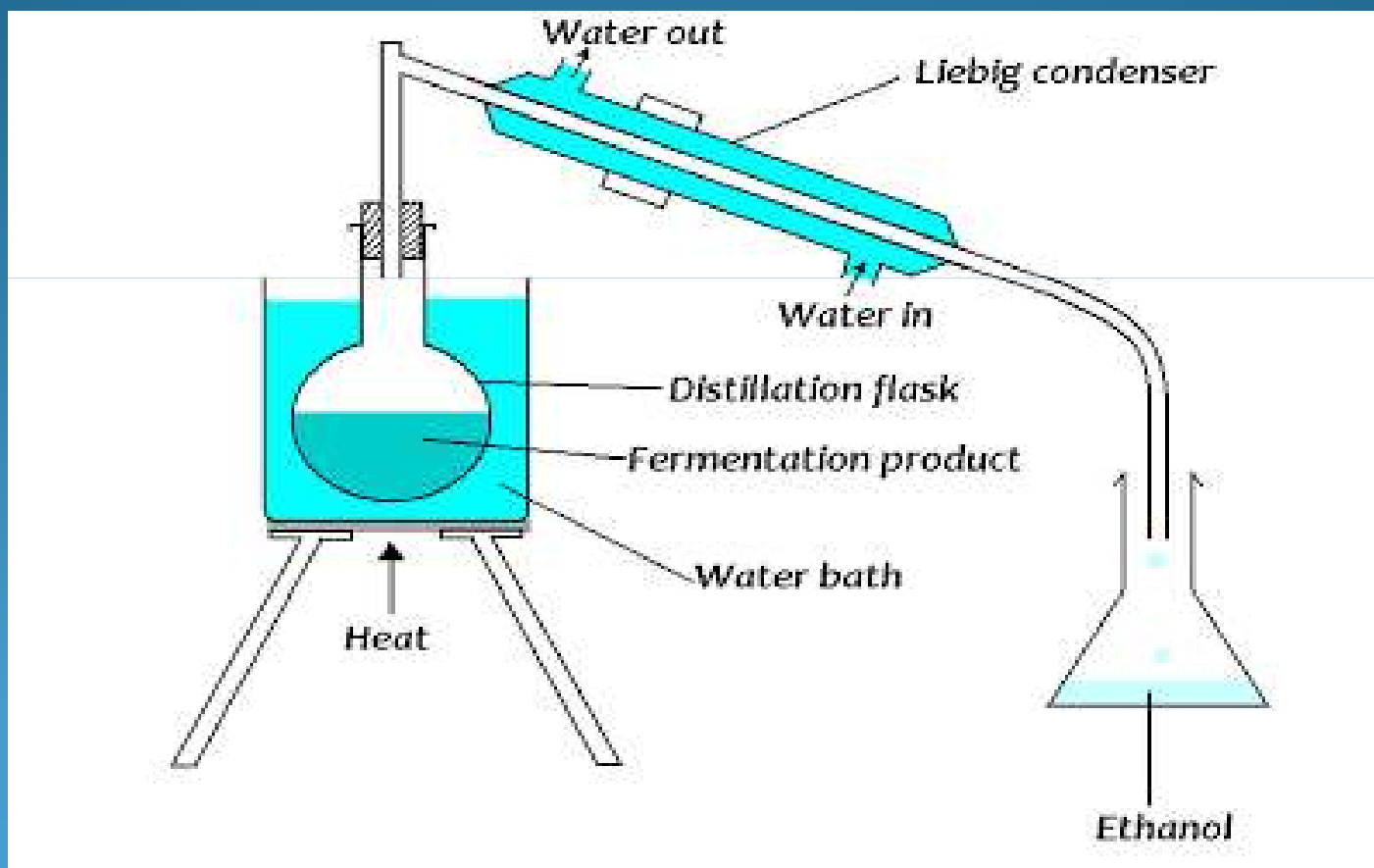
Sugarcane

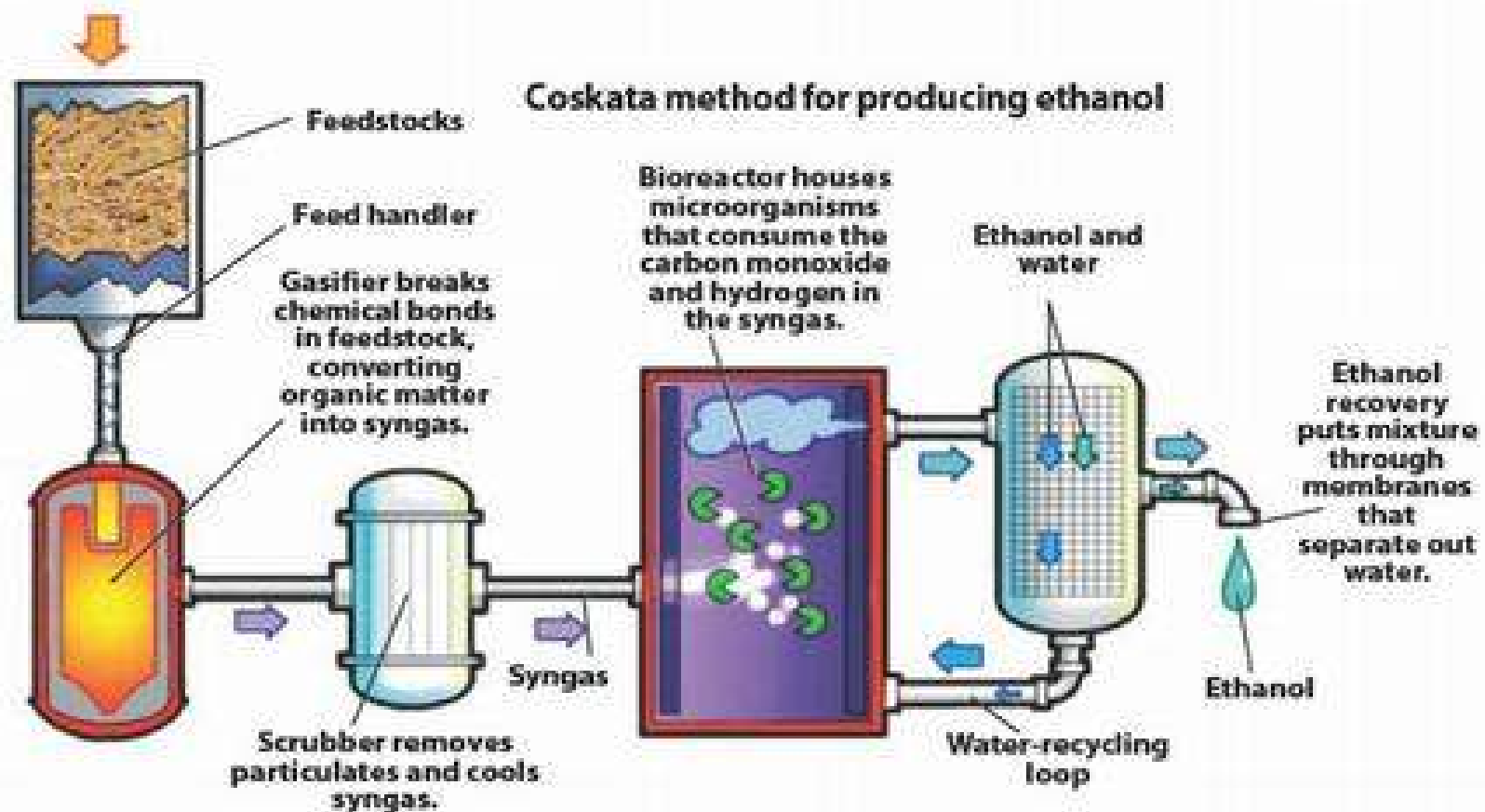


Biochemistry of Fermentation



Distillation of Alcohol



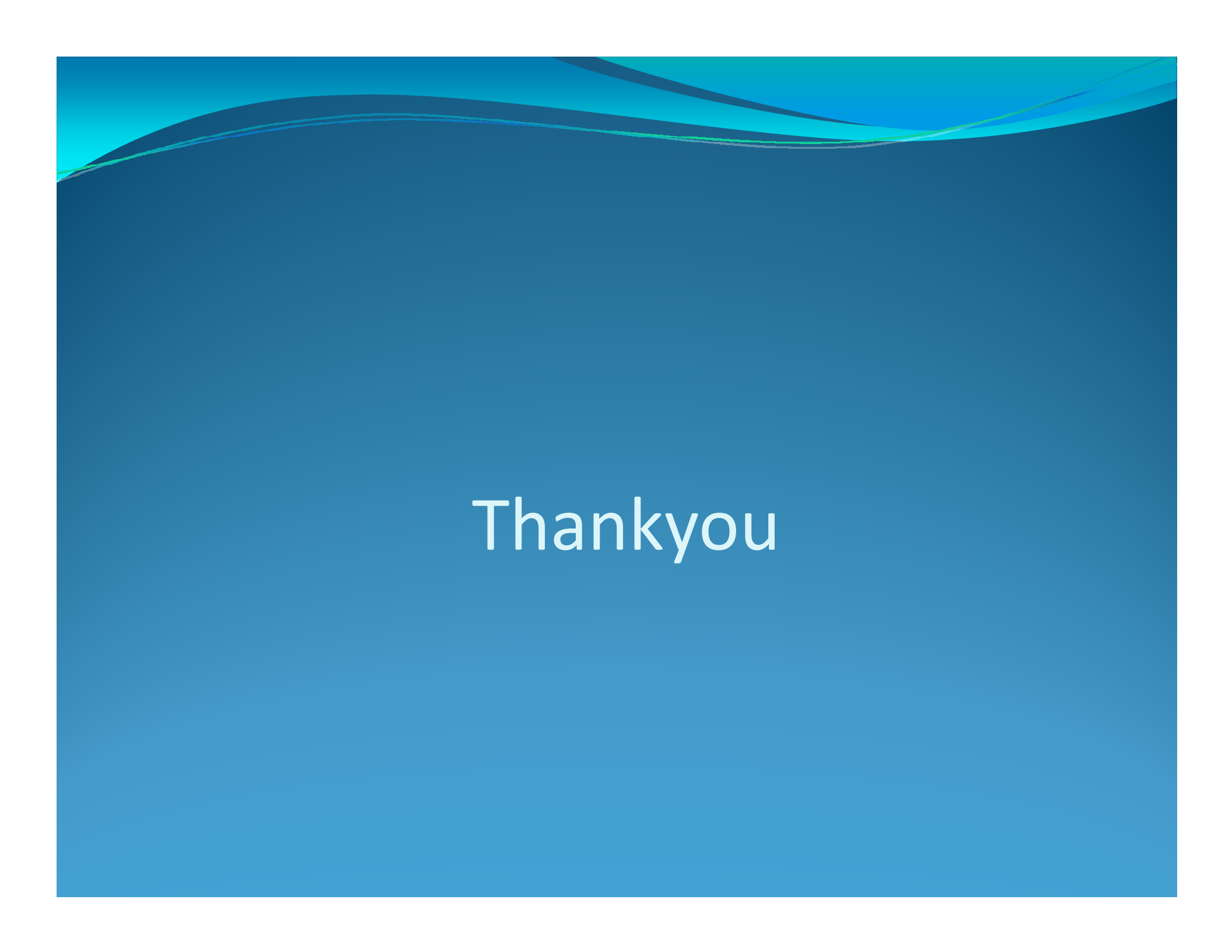


Uses of Alcohols

- The **liquor industry** is the most important outlet for high quality fermentation alcohol. The Liquor Products Act specifies the type of spirit (alcohol) upon which the various liquor categories may be based, as follows.
- The **personal care industry** (i.e., pharmaceutical, toiletry, perfumery and fragrance industries) also require high quality alcohol.

- **Chemical manufacture** is a large market for alcohol and large volumes of high purity synthetic ethanol are used in the manufacture of ethyl acrylate and ethyl acetate.
- It is then widely used in numerous **industrial applications**. Typical examples are the manufacture of solvent based paints, printing inks, lacquer thinners, etc.
- Blending of denatured anhydrous fermentation ethanol with petrol will give rise to **“biofuel”**. Internationally this is the fastest growing application for ethanol, i.e., fuel ethanol.

- The **food industry** accounts for some of the alcohol produced, but in a converted form. Alcohol is fermented by acetobacter to produce natural acetic acid or vinegar.
- Vinegar in turn is used as an acidulant in chutney, tomato sauce, mayonnaise, salad dressing and similar products.

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Thankyou