The cellulosic biorefinery: co-products extraction from biomass

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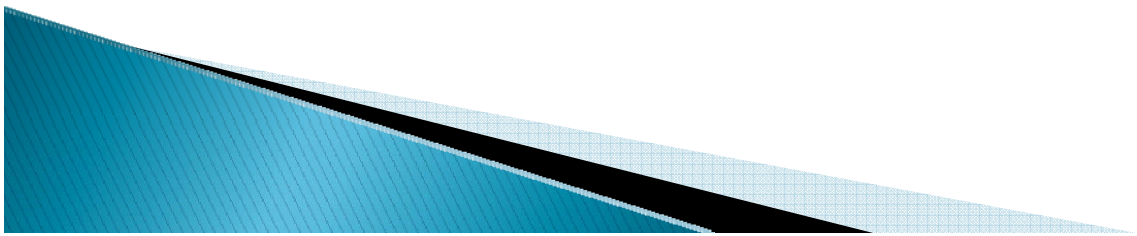
Overview

- The opportunity
  - Constraints
  - Examples



The opportunity

- Energy Independence and Security Act of 2007 Section 202 → 36 billion gallon/yr of advanced biofuels by 2022
- Corn to ethanol contribution → capped at 15 billion gallon/yr
- Advanced biofuels → production 21 billion gallon/yr of advanced biofuels
- 21 billion gallon/yr → 250 million dry ton of biomass

The opportunity

When biorefineries are deployed

Of the 250 million dry tons of biomass

Certain co-products Could be extracted

Prior or post conversion

Similar to the existing corn to ethanol biorefinery

Too early to bring specifics

Constraints

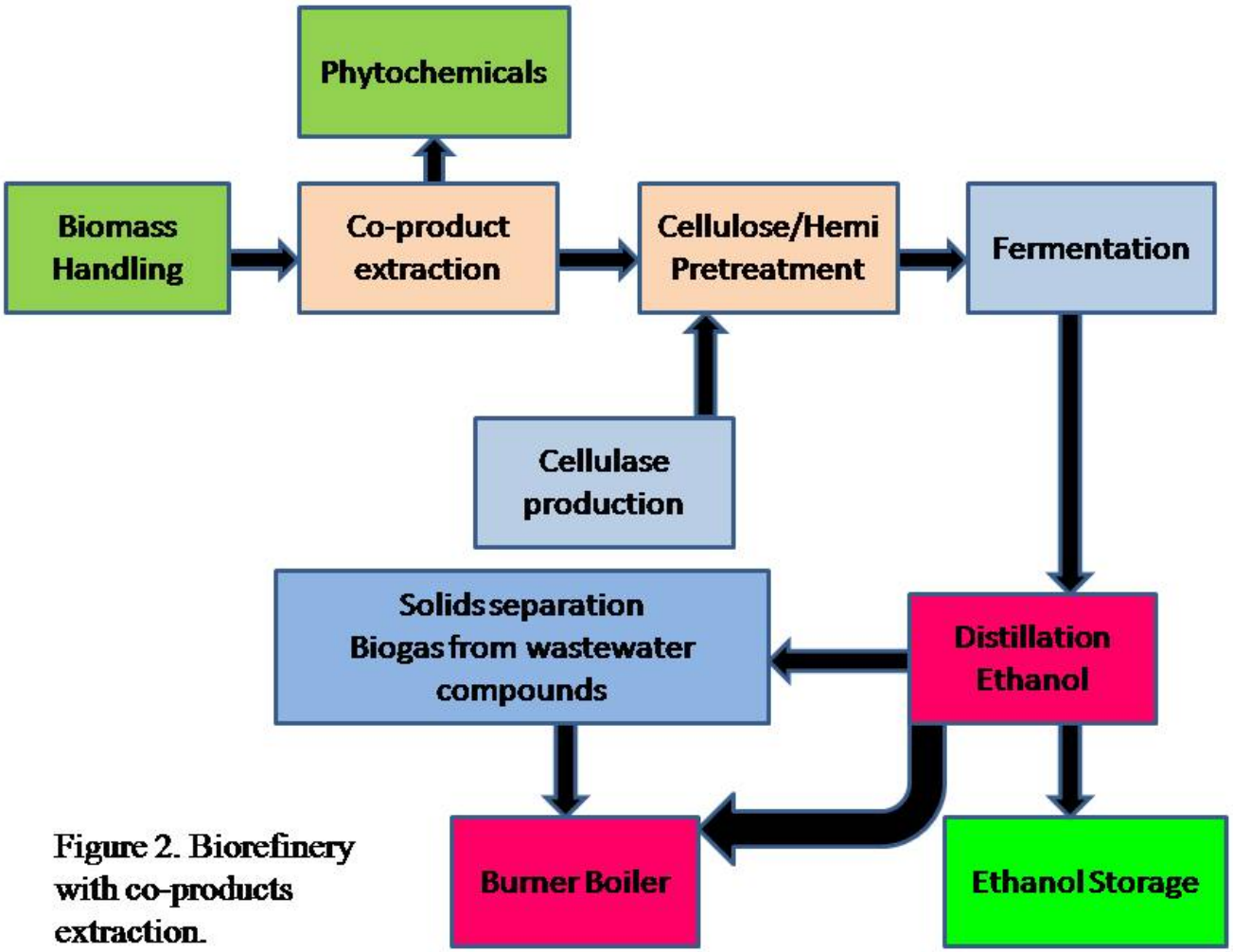


Figure 2. Biorefinery with co-products extraction.

Constraints

- Extraction step needs to be harmonized with biofrefinery bioprocessing
- Extraction needs to be in pressurized hot water below 140C
- Extraction could be in dilute acid
- Examples with pressurized hot water:
- Carvone *Mentha piperita*
- Linalool *Satureja hortensis*
- Paclitaxel *Taxus cuspidate*,

Constraints

- 50 million gallon per year
- 80 gallons per dry ton
- 2000 dry tons per day
- Co-products need to be extractable with pressurized
- Co-products need to be of sufficient value to warrant added step in biorefinery
- Market needs to be capable of absorbing production

Examples

- Black locust (*Robinia pseudoacacia* L)

Flavonoid → acacetin showed activity in cancer cell lines

Lectin → robin inhibits protein synthesis

Examples

- Eucalyptus

Flavonoid → showed activity as antioxidant

Monoterpenes → ingredient in Listerine® activity *Staphylococcus aureus*

Examples

- Sorghum

Policosanols
Inhibits oxidation of LDL key element in inflammatory dieses

Examples

- Sweetgum (*Liquidambar styraciflua* L.)

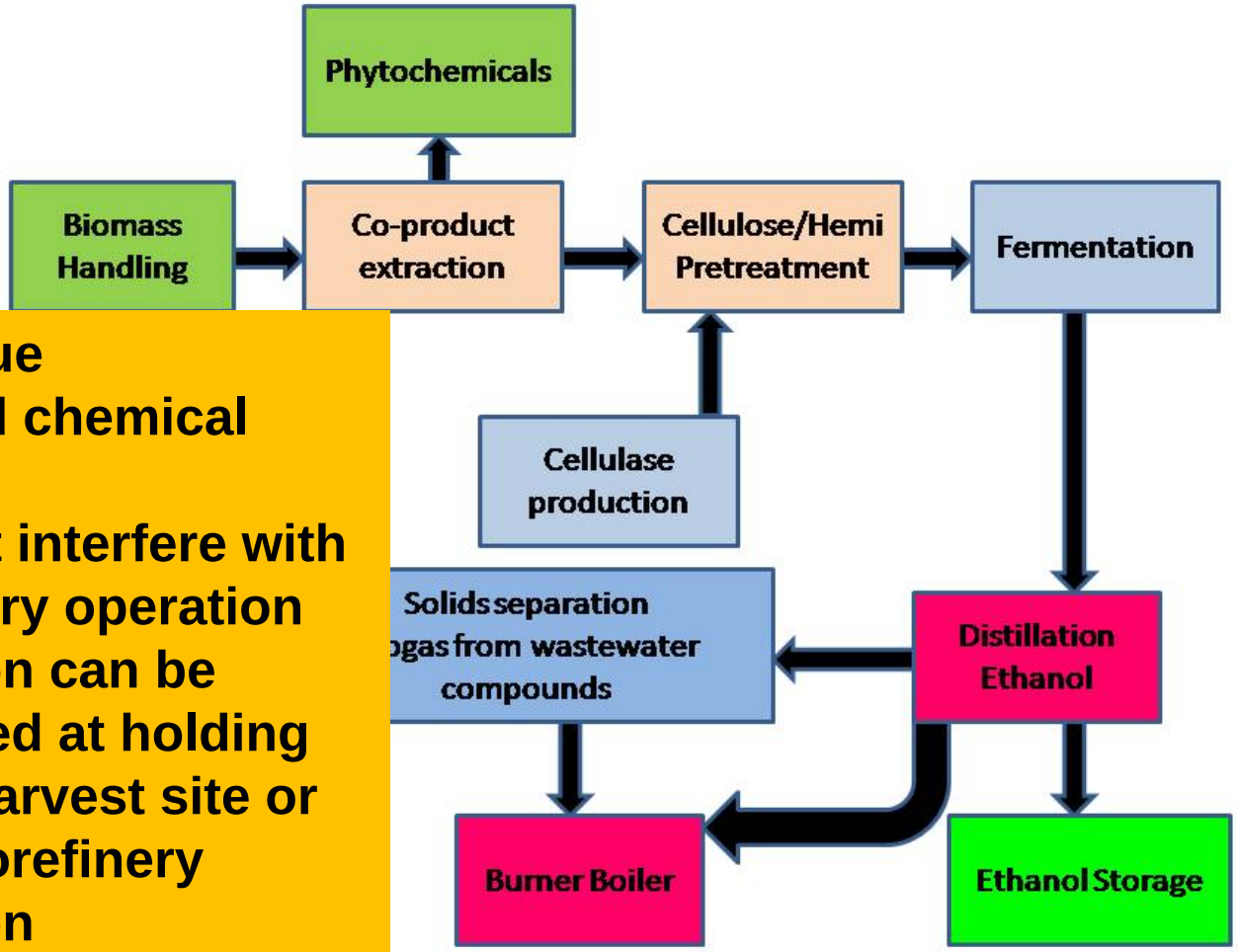
Essential oils composition is similar to that of Autralian tea tree oil antimicrobial and anti fungal activity

Examples

- Swicthgrass, *Panicum virgatum* L.

Policosanols →
Inhibits oxidation of LDL
Flavonoids →
rutin and quercitrin
antioxidants
Vitamin E →
antioxidant

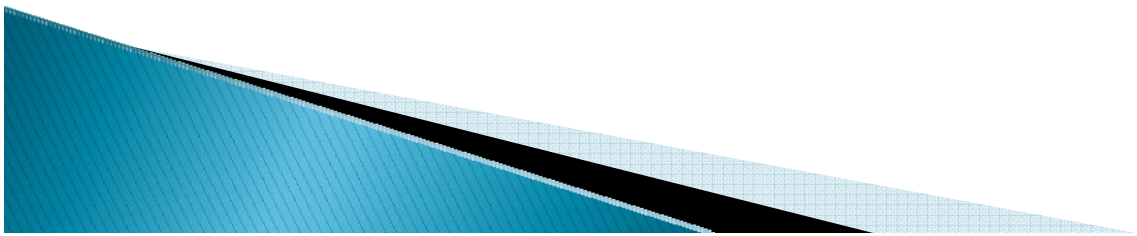
Feasible?



1. High value
2. Not flood chemical market
3. Does not interfere with biorefinery operation
4. Extraction can be conducted at holding site, at harvest site or at the biorefinery
5. Extraction infrastructure integrated

Conclusions

- The opportunity selected phytochemicals
- Constraints can be extracted with water or dilute acid
- Examples possible with specific biomass



Thank you

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