

Industrial Uses of Carbohydrate Crops

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The carbohydrate market

- We tend to think of non-food uses in isolation but in reality the carbohydrates are mainstream feedstocks in both food and non-food sectors. Hence the need to differentiate and ensure the best use for them in whichever market, bearing in mind the food versus non-food (esp biofuels) debate.
- Question - who is doing this and how?

Carbohydrates include many diverse sugars and sugar sources

- Simple sugars eg glucose; fructose
- 'Sugar' in the eyes of the general public as sucrose
- Complex sugars eg starches; lignocellulose

Some sugars are 'pop' whilst others are neglected eg. Xylans from Silver Birch for plastics manufacture

QUESTION- WHO IS INVESTIGATING ALL OF THE CARBOHYDRATES WE HAVE AND PRIORITISING USES?



So, the crops we think about most in terms of carbohydrates are the common ones we see daily. We forget that much carbohydrates trade is truly international and heavily price dependent



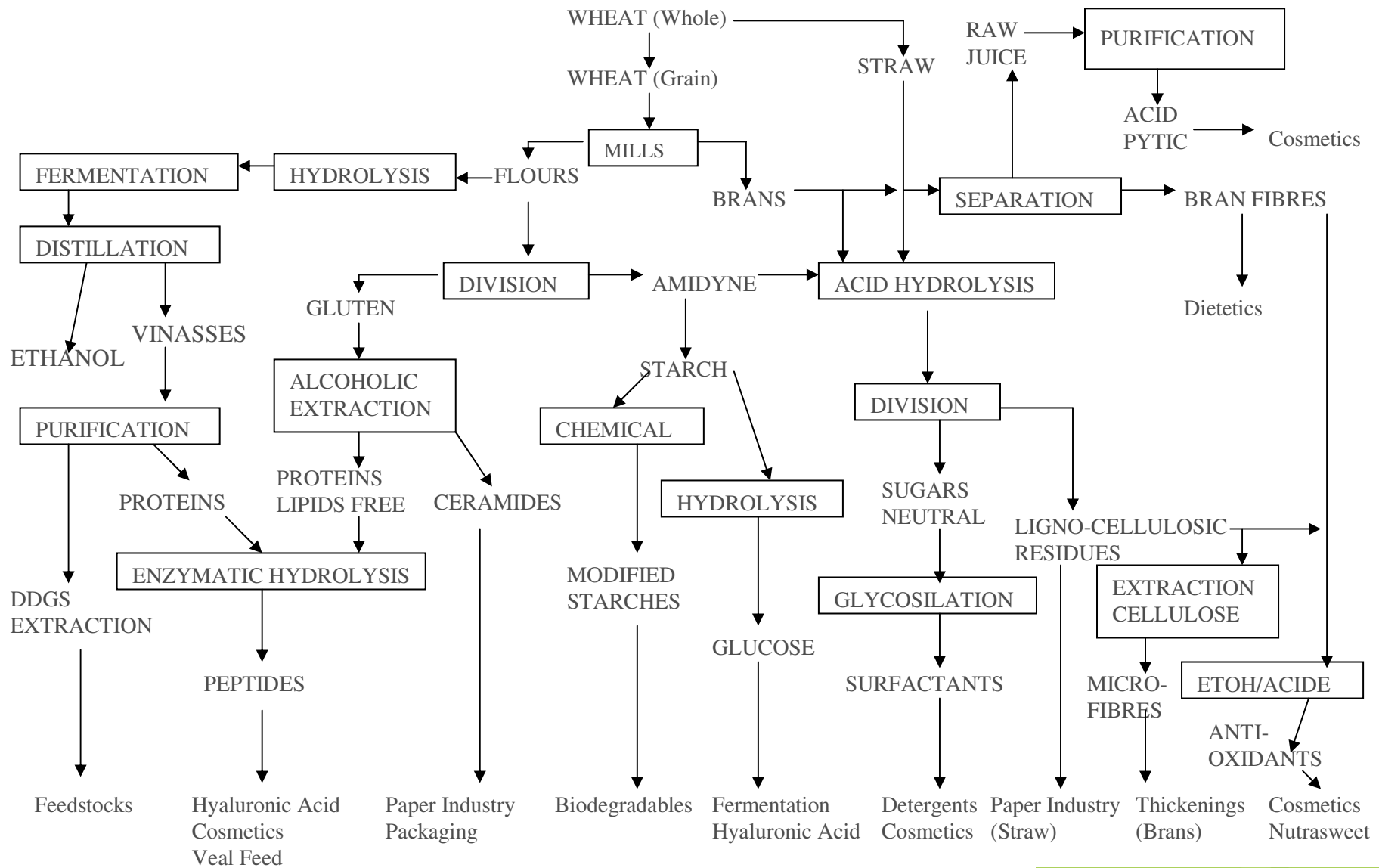






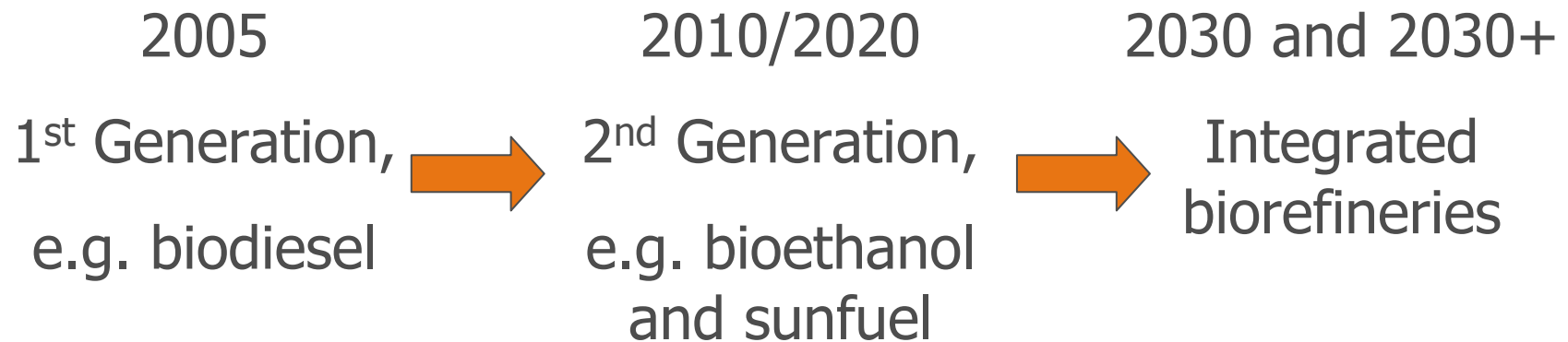
Additionally we tend to overlook co-products in carbohydrate sources and that science is moving on continually.

The Exploitation Potential of Wheat.



Technology roadmap: vision for biofuels for 2030+.

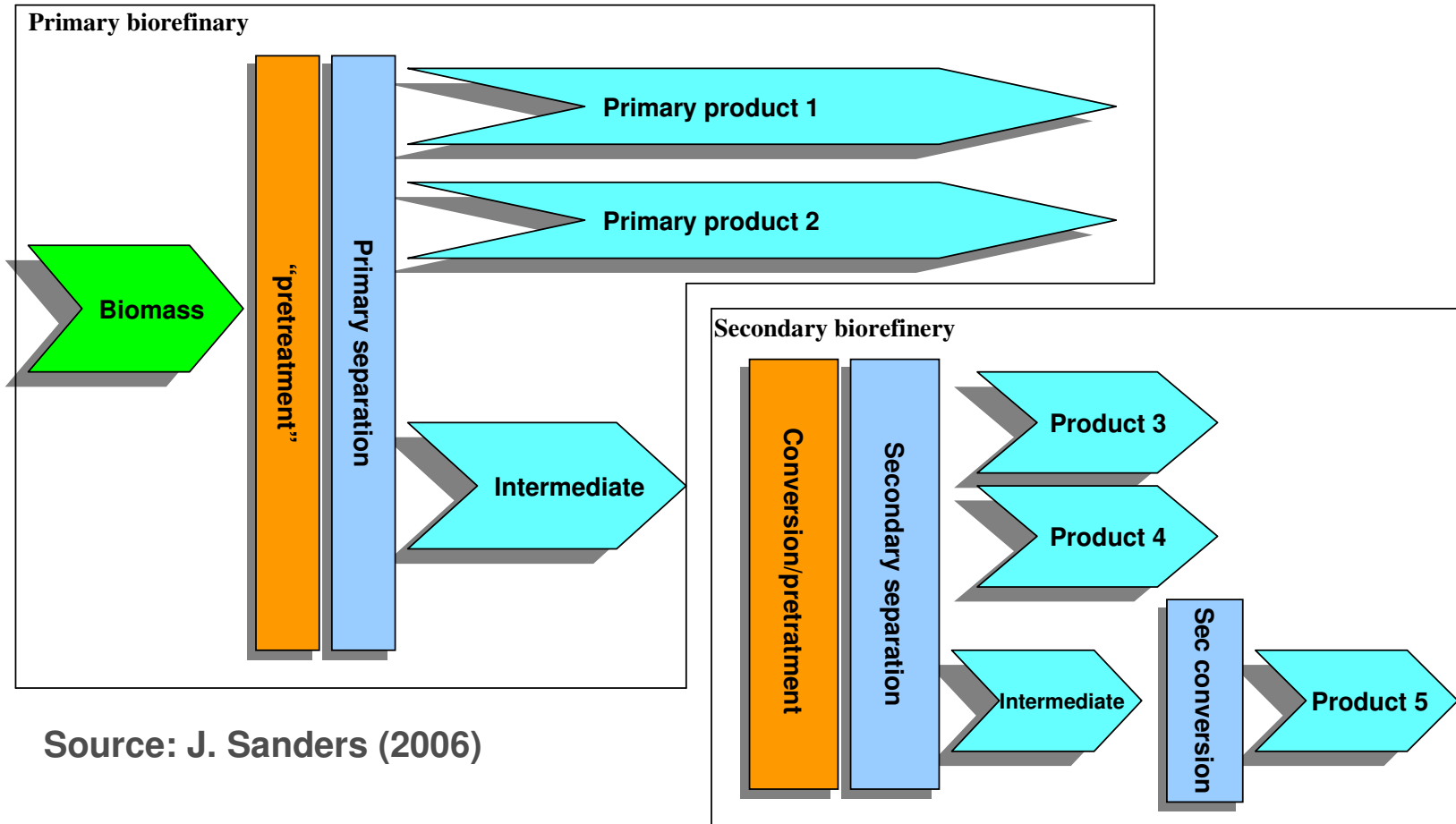
A European Vision.



Trees and Grassland.



Schematic overview general integrated biorefinery process.



Source: J. Sanders (2006)

So what are current outlets for
carbohydrates?

Here are the generic markets

Markets for carbohydrates- part 1

- Biofuels eg bio-ethanol
- Adhesives/glues
- Hydrolysis industries for sorbitol, glucose etc
- Pharmaceutical uses
- Textile finishing
- Paper manufacture
- Plastics manufacture

Markets for carbohydrates -2

- Construction industry
- Explosive manufacture
- Leather finishing
- Cosmetics industry
- Automotive manufacture

- And many more...and NB food where the carbohydrate is used as a filler or stiffener or ameliorant to improve texture

Here's a bit more detail for some markets

Plastics, films etc....

- Bio-plastics market is estimated to rise to 2.1 million tonnes per annum by 2013.

- Examples:-

Starch polymers - for loose fill, bags, wrap film eg Biolice; Biomax; Biopar; Solanyl; Cerestarch; Mater-Bi; Mulchfolie.

Cellulosics- for flexible films eg Nature flex; Clarifoil

PLA- for rigid barriers; barrier coatings; films eg Ecovia; Ingeo; Bioflex; Lactide monomer

Markets for Adhesives

- Hot melt glues
- Stamps; book binding; envelopes
- Wood adhesives and laminates
- Pressure sensitive adhesives
- Corrugation (eg boxes)
- Paper sacks

Cosmetics and pharmaceuticals.....

- Make up/ personal care eg shampoos
- Dusting powders
- Soap filler/ extender
- Face creams eg sucrose esters
- Coatings for tablets
- Binder for tablets; dispersant for medicines; controlled-release agent
- Blended sweeteners for medicines eg cold remedies
- Coating spheres for capsule medicines

Construction industry.....

- Starches for -
 - Concrete block binding
 - Asbestos; clay/limestone binding
 - Fire-resistant wall board
 - Paint filler
 - Gypsum (plaster board) binder

And more.....

- Paper industry eg starch in sizing; feminine care products; babies' nappies; filler retention; finishing surfaces
- Explosives eg as binder in explosives and in matches
- Textiles eg starch in finishing; warp sizing; printing
- Printing inks eg sucrose benzoates for water based inks.

Some brief conclusions

- Many carbohydrates markets are well developed although newer ones are coming on stream eg plastics
- International price drives much of carbohydrates purchase and utilisation
- Much carbohydrate, esp starch is used as a non -food material in food
- There is probably too much emphasis on 1G biofuels from sugars.
- Someone needs to stand back and critically analyse opportunities and markets.



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