Alternative uses for brewers' spent grain

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BSG preservation techniques

Due to its high moister and fermentable sugar contents, BSG is a very unstable material and is liable to deteriorate rapidly due to microbial activity. [1]

Drying

The advantage of drying is that it reduces the product volume and therefore reduces the transport and storage costs. There are four different methods of drying: rotary drum driers, oven drying, freeze-drying, and freezing.

- Rotary drum driers work, however, they are energy intensive.
- Oven drying must be conducted at temperatures less than 140 degrees F, since at higher temperatures it generates unpleasant flavors. There are additional risks of burning the grain at the end of the process.
- Freeze-drying does not alter the composition of BSG, but it is economically unacceptable.
- Freezing is inappropriate because large volumes must be stored, and it may alter the composition of BSG.

Other Techniques

- Chemically: Lactic, formic acetic or benzoic acid mixed with water and BSG effectively preserved it for three summer months.
- Vacuuming: Initial experiments showed that BSG stored in vacuum slowed the growth of microbials. These results are promising.

Alternative uses of BSG

List of Applications:

- Biogas production and burning of BSG: This was first implemented by German companies BMP Biomasse Projekt and INNOVAS in a test facility. They were able to recover more than 50% of the plant's consumed energy.
- Biogas Production: Aerobic/anaerobic digester creates 1.3 million BTUs per 1 metric ton wet spent grain. Currently implemented successfully by PurposeEnergy, Inc.

- Vertical Farm: Blake Davis of IPRO 336 is developing a vertical farm which will use BSG for
  - Biogas production
  - Fish feed
  - Plant nutrients
  - Mushroom growth
- Charcoal Production: Higher energy output than wood, but also a higher ignition temperature. [2]
- Brick Component: Used to increase porosity of brick without any negative effects. It may be substituted for sawdust.
- Dye Absorbent: Absorbs cadmium, lead and chromium better than other low-cost biological absorbers.
- Paper Production: BSG has been used to prepare paper towels, business cards and coasters.
- Food Production:
  - Granola and crackers
  - Spent grain bread
  - Dog biscuits

List of Other Applications:

- Biotechnological Processes
- Bioethanol Production
- Lactic Acid Production
- Hydroxycinnamic Acid Production
- Xylitol and pullulan Production
- Substrate for Cultivation of Microorganisms
- Substrate for Enzyme Production
- Source of added-value products

Brewers in Chicago

Brewpubs

Brewery Name	Location	Annual BSG Waste (Pounds)
America's Brewing Company	Aurora	32,000
Emmetts Tavern & Brewing	Palatine	50,000
Emmetts Tavern & Brewing	West Dundee	50,000
Emmets Alehouse #2	Downers Grove	50,000
Flatlanders Restaurant & Brewery	Lincolnshire	52,000
Flossmoor Station Brew Pub	Flossmoor	30,000
Gordon Biersch Brewery and Restaurant	Bolingbrook	20,000
Granite City Food and Brewery	Orland Park	25,000
Hamburger Marys	Chicago	30,000
Harrisons Restaurant and Brewery	Orland Park	40,000
Haymarket Pub and Brewery	Chicago	36,000
Limestone Brewing	Plainfield	50,000
The Lucky Monk	South Barrington	52,000
Mickey Finns Brewery	Libertyville	78,000
Moonshine	Chicago	39,000
Onion Pub and Brewing Co	Barrington	90,000
Piece Brewery	Chicago	90,000
Ram/Big Horn Brewing	Schaumburg	72,000
Ram/Big Horn Brewing	Wheeling	72,000
Revolution Brewing	Chicago	50,000
Rock Bottom	Chicago	48,000
Rock Bottom	Lombard	72,000
Rock Bottom	Orland Park	72,000
Rock Bottom	Warrenville	72,000
Stockholms Vardus	Geneva	5,000
Three Floyds Brewing Co	Munster	78,000

Microbreweries

Brewery Name	Location	Annual BSG Waste (Pounds)
Argus Brewery	Chicago	90,000
Doubleheart Brewing	Chicago	30,000
Half Acre Beer Company	Chicago	72,000
Metropolitan Brewing	Chicago	120,000
Two Brothers	Warrenville	192,000

Regional Brewers

Brewery Name	Location	Annual BSG Waste (Pounds)
Goose Island Beer Company	Chicago	2,160,000

References

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[2] S. Aliyu, and M. Bala. *Brewer's spent grain: A review of its potentials and applications.* African Journal of Biotechnology Vol. 10(3), pp. 324-331, 17 January, 2001