

Animal Feed Additives.

By far the most common use of spent brewers grain is as animal feed, primarily for cattle, but also for pigs, goats, fish and just about any other livestock. It contains, fiber, protein, vitamins and carbohydrates, which makes for a good feed additive. A diet of up to 25 percent spent grain is ideal for livestock.

Absorbent

Textile and dye industries use enormous volumes of water for wet processing. This leaves significant amount of pollutants in the water. Spent grain has been shown to be effective in wastewater removal of these organic dyes. The sorption properties of spent grain are due to the presence of functional groups such as hydroxyl, carboxyl, and amine groups, which have a high affinity for metal ions.

Vertical Farming

The Plant, Chicago's first vertical farm is a finalist for a grant from the State of Illinois to build a large anaerobic digester. This could utilize all the spent grains produced by all the micro-breweries in the Chicago area. We anticipate that the anaerobic digester will be completed in late spring of 2012. The advantage to the brewers with this arrangement is that the spent brewer's grains would all be utilized in a sustainable way instead of being land filled. In addition to producing energy and waste heat, which we would use at the plant, the sludge from the digester would be available as a high-nitrogen, compost for raising plants. Nothing would be wasted, and less greenhouse gases would be released than by land filling the materials. The spent grain will be used for biogas production, fish food, plant nutrients, and mushroom growth



Project Methodology

The process to attaining our end goal: Embark on extensive research: we made a list of breweries, with their contact details and we divided these companies amongst ourselves. We called them and had a short interview, talking about how they use their spent grain, and a list of other in-depth questions. We collected information on the cost of discarding spent grain. We also researched for the most cost effective way of turning spent grain into a beneficiary product. In addition to this we did an experiment to determine the effects of drying, vacuuming, and salting. We also had talks with professors and experts in the field come talk to our IPRO about steps towards attaining our goal.

Conclusions

As noted, spent grain has multiple viable uses. As a group we outlined all the possible alternatives thus presenting the brewer with a choice to pick which alternative is best suited for them. Future IPRO groups might decide on which one is the most viable of all the options, but for now the possibilities are endless.



The Idea Fermenters

340

Mashing Up Ideas
for Tuns of Results

IPRO 340: BUSINESS STUDY OF ALTERNATIVE USES FOR BREWERS' SPENT GRAIN

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Problem Statement:

The problem we are addressing is the fact that spent grain that breweries inevitably produced, is being discarded by small breweries, while there lies within it a potential of being a source of income and benefit to the brewery and the customer respectively. The Idea Fermentors (IPRO 340) will work with the sponsor company, Rock Bottom Brewery, to identify alternative uses for spent grain, a valuable by-product of the beer brewing process.

Objectives

Our team will be conducting research on different alternatives to dispose of spent grain. We will be contacting and visiting multiple breweries to investigate different methods of spent grain disposal and then comparing them based on efficiency, cost, reliability, time, etc. From the research, we hope to find the most efficient alternative for the disposal of spent grain and then present this information to our collaborating sponsor, Rock Bottom.

What is Spent Grain?

Spent grain is the main by-product of the brewing industry, representing approximately 85% of total by-products generated. Brewers' spent grains are of high nutritive value and contain cellulose, hemicelluloses, lignin and high protein content. It is a readily available, high volume low cost by-product of brewing and is a potentially valuable resource. **The problem brewer's are having is what to do with the spent grain because it is a commodity produced in abundance that should not be wasted.**



Biogas

Tests done in the Nnamdi Azikiwe University, Nigeria, indicated that brewers spent grains can be utilized for biogas production when digested anaerobically. They produced 58-65% methane and the sludge generated thereafter can provide high quality manure since nitrogen content of the stabilized bio-wastes increased at the end of the digestion as revealed by the proximate analysis.

Composting

Spent grain is rich in Nitrogen and Organic material, which is good for the compost pile. The carbon ratio ranges from 17:1 to 12:1. The good thing about composting is that the drying of the spent grain will not be too consequential, thereby, saving some costs. Spent grain needs to be mixed with high carbon materials to compost efficiently. It also needs to be mixed with coarse materials, to create anaerobic pockets for aeration. If this is done efficiently, spent grain will be a farmer's delight.

Mushrooms

Spent grain compost can also be used as a growing medium for mushrooms. Not only is it a simple process, but it also eliminates the problem of drying or freezing spent grain for maintenance purposes. Spent Grains when worked into a process, are a perfect environment for growing mushrooms like shitake and oyster.

Bricks

When spent grains are used to make bricks, the bricks stand out amongst their peers. After firing for a day, the bricks produced possess a comparable or higher strength, a higher porosity, a reduced density, when compared to the bricks of standard production clay. The low amount of ash coupled with the high amount of fibrous material make spent grains suitable for use in building materials. So they make a good replacement for sawdust in the making of bricks.

Xylitol

Xylitol is a sweetener that can be used to combat dental carriers and treat diabetes. BSG contains xylose, glucose and arabinose. polymerised into cellulose and hemicellulose. Thus, if submitted to a fractionation process under adequate conditions, BSG may produce liquor rich in xylose, a sugar that can be used as a carbon source for xylitol or ethanol production

Paper

BSG is high in hemicellulose (28.4% w/w) and extractives (5.8% w/w) contents. This affects the pulping process. However, soda pulping of acid pretreated BSG gives a cellulose-rich pulp (90.4% w/w) and, although the pulp yield might be low (33.5%) due to the BSG chemical composition, the pulp properties will be good, and therefore it can be used in blends with other pulps or pulped with other raw materials

Charcoal

According to some Japanese inventors, the charcoal bricks made from BSG have a potential of having a high calorific value of about 27MJ/Kg, The contents of nitrogen and phosphorus in these charcoal bricks were 9-20 times and 40 times greater than those of Bincho-tan and Oga-tan, respectively, so they have the possibility to be used as a source of natural minerals.