



Nutritional and Health Potential for Spent Brewery Yeast

A brief overview

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Introduction

Spent yeast constitutes a considerable portion of brewery by-products. While some breweries sell their waste yeast quite successfully for processing into those marvellous products such as marmite and vegemite, many breweries have their spent yeast sold as animal feed.

With the advent of intelligent waste utilisation or re-labelling waste as value-added alternative commodities, excess yeast from breweries have great potential to be utilised in the production of health and nutritional value-added alternative commodities.

Some proven examples of this are given here:

Nutrition related:

- Food flavouring
- Fat replacers
- Vitamins
- Minerals

Health related:

- Antidepressant
- SAME
- Wound healing
- Glucose Tolerance Factor
- Immuno modulator

Antidepressant

Yeast is a rich source of S-adenosyl-L-methionine (SAME), which has been successfully used as a potent antidepressant (Bressa, 1994; Mischoulon and Fava, 2002), in the treatment of alcoholic and general liver disorders (Lieber, 2002; Purohit and Russo, 2002); and in the management of osteoarthritis (Najm et al., 2004). All with no or minimal side effects. As an antidepressant, SAME acts predominantly through the action of methyltransferases that shifts the methyl group on SAME to a variety of potential methyl-group acceptors such as neurotransmitters and other biogenic amines (Mischoulon and Fava, 2002). Typically people suffering depression have relatively low plasma SAME levels, administration of SAME usually alleviates symptoms of depression. SAME has been found to be as effective as conventional antidepressant drugs (Bressa, 1994), which allows the use of spent brewer's yeast derived SAME as a valuable natural alternative to conventional antidepressant drugs. Yeast hydrolysate, as a crude preparation, has also been shown to have an anti-stress effect similar to SAME (Kim et al., 2002; 2003), which suggest that crude yeast preparations can induce physiological effects similar to highly purified preparations.

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Wound Healing

Purified yeast glucan has been found to be an effective stimulant of wound healing (Kaplan, 1984; Wolk and Danon, 1985; Crowe et al., 1999). The use of glucan-based skin grafts has shown remarkable improvements in postburn survival through a reduction in postburn hypermetabolism, infection rates, and a more rapid natural wound sealing. Further improvements in wound healing have been made by combined β -glucan with collagen (Delatte et al., 2001), or by the use of carboxymethylated β -glucan (Zulli et al., 1996). The latter has been promoted as a cosmeceutical that can act as a skin-protector against potential damage caused by UV-A exposure (Zulli et al., 1997).

Immuno Modulator

As mentioned above, brewer's yeast has the ability to affect the recovery of wound healing through the action of β -glucans. Most of this activity can be traced back through the apparent priming of innate immune effector cells (Li et al., 2006). This will essentially cause the overall immune system to be more effective in combating non-self cell types, such as tumor cells (Li et al., 2006; Ghoneum et al., 2006; Kong et al., 2002). This mechanisms has been argued to be due to the increased activity of macrophages (Hansel, 1987; Li et al., 2006).

Fat Replacer

The β -glucans and mannoproteins associated with the yeast cell wall have both been identified as efficient fat replacers (Cameron et al., 1988; Barriga et al., 1999; Worrasinchai et al., 2006). The proteins associated with the mannoproteins appear to be very effective bioemulsifiers, whereas the phosphomannans enhances the emulsification properties of the mannoproteins (Barriga et al., 1999). Due to their string water binding ability, β -glucans are very effective fat replacers and have been successfully applied as such in low-fat mayonnaise and low-fat cheeses (Worrasinchai et al., 2006; Konuklar et al., 2004). Apart from the role as fat replacer in low-fat foods, β -glucans have also been found to lower plasma cholesterol levels (Robbins et al., 1977; Nicolosi et al., 1999), while even reducing body fat deposits (Kim et al., 2004).

Glucose Tolerance Factor

Brewer's yeast has been identified as the source of a glucose tolerance factor (GTF) (Schwarz and Mertz, 1959). The GTF improves the rate of glucose removal from the bloodstream in case of low or insufficient insulin response (Toepfer et al., 1977; Davies et al., 1985). The actual GTF has been identified as trivalent chromium, as it is incorporated into yeast proteins this allows for very efficient absorption of the mineral. The use of brewer's yeast as a source of GTF has been found to effectively maintain appropriate blood glucose levels in people suffering of non-insulin dependent diabetes (Grant et al., 1982; Offenbacher et al., 1990; Cefalu et al., 2004). Linked to the alleviating effect of yeast-chromium on blood glucose for diabetes, is the role that yeast-chromium plays in combating acne. It has been shown that acne can be caused by rapid fluctuations in insulin, which can be offset by the administration of brewers yeast (McCarty, 1984; Weber et al., 1989).

Source of Minerals

Yeast contains a wide variety of minerals, some of which have shown to be easily accessible when contained within yeast. A clear example is the presence of chromium in yeast (see GTF), and magnesium. One specific trace element that has been shown to accumulate in yeast is selenium (Lipson et al., 1988; Rayman, 2004). Selenium is required by animals to reduce rates of inflammation, facilitate DNA and hormone synthesis, and plays a role in fertility and reproduction (Rayman, 2000). While deficiencies in selenium in the human diet are rare, the use of yeast as a delivery system for selenium has shown to be very efficient (Lipson et al., 1988) and have found applications in both human nutrition and in agriculture. Similar to the GTF, yeast's effectiveness as an efficient delivery vehicle is due to the incorporation of the minerals into proteins which allow for rapid absorption and high bio-availability.

Source of Vitamins

Due to its capacity of rapid growth and fermentation, brewer's yeast contains a wide variety of vitamins at relatively high concentrations.

Thiamine is an essential cofactor in all enzymes involved in pyruvate decarboxylation. Both beer and yeast have the potential to provide thiamine as a nutrient source (Katz et al., 1985).

Megaloblastic anemia is typically associated with deficiencies in folic acid and vitamin B12 (Rolfes et al., 2006). Brewer's yeast (as marmite) has been shown to provide potent supply of both vitamins in cases of megaloblastic anemia (Ungley, 1950; Vinke, 1964).

Other vitamins typically associated with brewer's yeast are: riboflavin, niacin, pantothenic acid, pyridoxine and biotin.

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