ISSN 1777-5566

FEEDINFO
NEWS SERVICE

> Scientific Reviews

Categories: Broiler Nutrition | Layer Nutrition | Poultry Health

Saccharomyces cerevisiae and Rhizopus oligosporus, the Promising Agent for Controlling of Aflatoxin B1 Contamination in Poultry Feed

Source: Eni Kusumaningtyas & Raphaella Widiastuti - Research Institute for Veterinary Science, Indonesia
(dated 02/04/2007)

Feed safety is becoming more of a concerned issue since poultry feed all over the world is frequently contaminated by aflatoxins. Aflatoxins level in animal feedstuff has been raising problems to reduce or eliminate these compounds. A recent study found that some microorganisms such as bacteria, yeasts and molds can be potential agents for controlling the contamination. However, strains and conditions of cultivation should be carefully considered to obtain the expecting result.

What is aflatoxin?

Aflatoxin is a group of closely related and biologycally active mycotoxins produced by strains of Aspergillus flavus and Aspergillus parasiticus. These fungi have the ability to invade various agricultural commodities such as corns, peanuts, cottonseeds, and various tree nuts. Aflatoxin B1 (see Fig 1.) is the most toxic and best studied of the compounds. The toxic effects include acute hepatitis, immunosuppression, and hepatocellular carcinoma. In human, the risks associated with aflatoxins consumption have been well documented, and the International Agency for Research on Cancer (IARC) has designated aflatoxins as a human liver carcinogen class I.

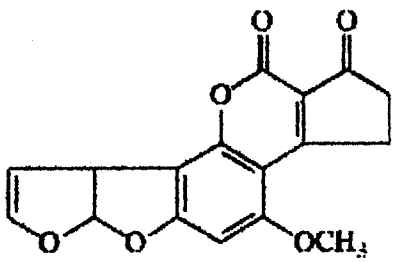


Figure 1. Chemical structure of aflatoxins

Aflatoxins contamination can reduce bird's resistance to disease and their ability to withstand stress by inhibiting immune system. Anorexia, decreased weight gains, lower egg production, poor feed utilization, and hemorrhage are also commonly present as clinical signs. The metabolites of aflatoxins can also be deposited in animal tissues and eggs after the consumption of contaminated feed.

Numerous strategies for the detoxification or inactivation of aflatoxin contaminated feedstuffs have been used, such as physical separation, thermal inactivation, irradiation, and treatments with a variety of chemicals. Currently, the promising research approach is through biological control. Biological detoxification can be defined as the enzymatic degradation or biotransformation of aflatoxins. The biological controls include the use of microorganism as a biocompetitive agent and genetically engineered plants for reducing aflatoxins contamination.

The potency of bakers yeast (Saccharomyces cerevisiae) and Rhizopus oligosporus to reduce aflatoxin contamination in poultry feed.

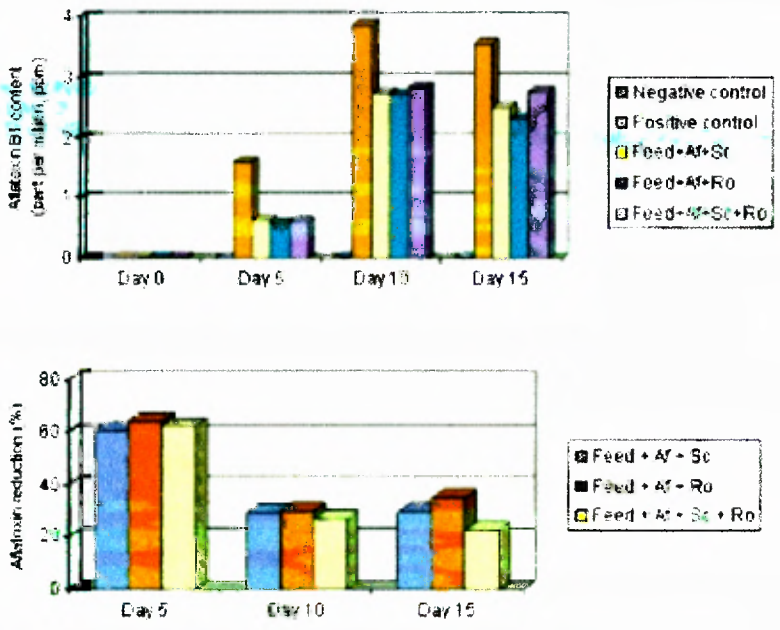
New approach using microorganisms to prevent aflatoxins contaminations become popular since the

microorganisms decrease or inhibit aflatoxins production by toxigenic strains of A. flavus and A. parasiticus on artificial media, sterile substrates and in the field. The bakers yeast (Saccharomyces cerevisiae) and Rhizopus oligosporus, fungi used in the preparation of tempe, were reported to be able to inhibit the growth of A. flavus and A. parasiticus and also aflatoxin production.

S. cerevisiae has high nutritional values containing 40-45% protein and vitamin B complex. Suplementation of dietary S. cerevisiae and their compound exhibited nutritional benefaction in performance as well as suppression of aflatoxicoses in laying hens and broiler chicks. Whereas, R. oligosporus was generally the best vitamins former in tempe solid substrate and is commonly used commercially in animal feed industry to improve nutritional quality of feed.

In facing aflatoxins problems, S. cerevisiae and R. oligosporus provide promising results. S. cerevisiae grew and multiplied faster than A. flavus producing aflatoxin. Consequently, suppression of A. flavus growth affects the aflatoxin content in feed. Reduction of aflatoxin in feed may also due to the compound in S. cerevisiae itself. Mannanoligosaccharide or b-D-glucans may play an important role in the action. Modification of mannanoligosaccharide was reported to bind aflatoxins up to 88% while □-D-glucans form hydrogen bonds or van der walls interaction with aflatoxin B1.The same result was also demonstrated by R. oligosporus. Rhizopus spp. were also reported to be able to degrade and prevent synthesis of aflatoxin B1 more than 90% in a liquid culture medium.

Figure 2 Illustrates the effects of S. cerevisiae (Sc), R. oligosporus (Ro) and their combination (ScRo) to reduce aflatoxin B1 content in chicken feed when they grew together with A. flavus (Af). At day 0, aflatoxins contents are relatively in the same level. Up to 15 days, positive control containing feed and A. flavus without treatment contained the highest level of aflatoxin B1.The results indicated that Sc, Ro and ScRo were able to reduce aflatoxin content in feed. Among the other, the treatment with Ro seems provide the best result. At day 15, aflatoxin B1 level decreased in all treatment including in the positive control. The previous research reported that aflatoxin would degrade naturally after the optimum concentration was achieved. The aging mycelia was assumed to release intramycelial substance, which was able to degrade aflatoxin. The substance would increase as the mycelial aged. Interestingly, at day 10 and 15 the activity of ScRo was lower than that of Sc or Ro although aflatoxin B1 level is not significantly different (P>0.05). Therefore, they may be better used individually.



Source: Kusumaningtyas *et al*., 2006

Figure 2 The effect of Sc, Ro and ScRo treatments on Aflatoxin content in feed (a) Percentage of aflatoxin reduction in feed with Sc, Ro and ScRo addition (b)

Consideration factor

Although S. cerevisiae and R. oligosporus revealed good results to reduce aflatoxins in some experiments, strains, sources, media and condition of cultivation, such as pH or temperature are the critical factors. Screening the strains is required because differences between yeast or mold strains demonstrated different capacities. Nutritional containment and solid or liquid media would also affect the growth and sometimes characteristic of the fungi. For example, lactic acid and nitric acid enhanced germination of R. oligosporus in liquid medium, but not in solid-state such as tempe. Inoculation of R. oligosporus at various temperatures resulted different periods for the lag phase of fungal growth. Suppressing or increasing capacity to reduce aflatoxin in feed also depends on the composition of microorganisms that grow together. Growing other microorganisms together with S. cerevisiae or R. oligosporus competes or influences the changing of environment and then affects the ability to reduce aflatoxins. (From many sources)

For further information on this research, feel free to contact:

Eni Kusumaningtyas,
Department of Mycology
Research Institute for Veterinary Science
Jl RE Martadinata 30
Bogor, 16114
Indonesia
E-mail: **enikusuma@yahoo.com**