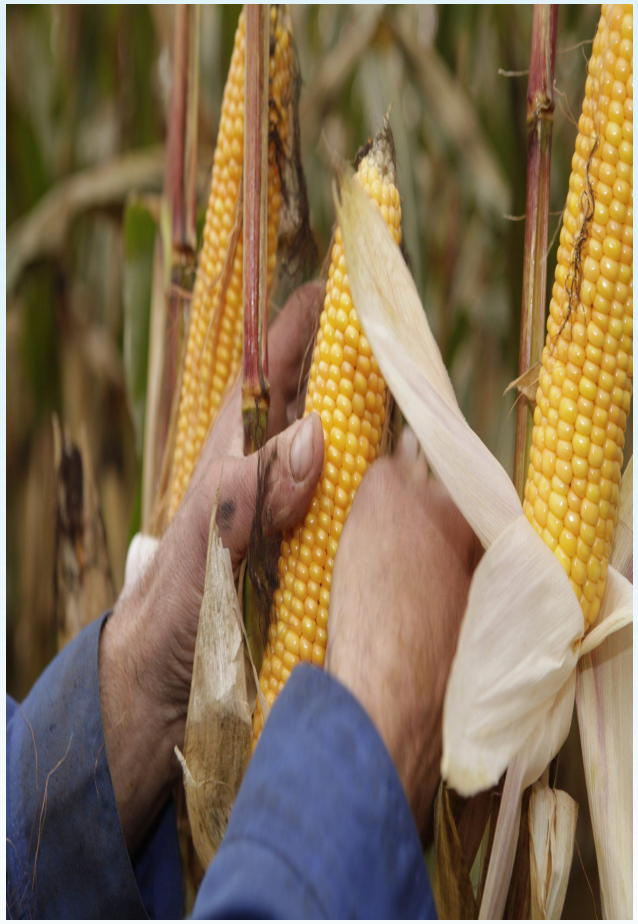
4. Post-harvest prevention and control of AFB1

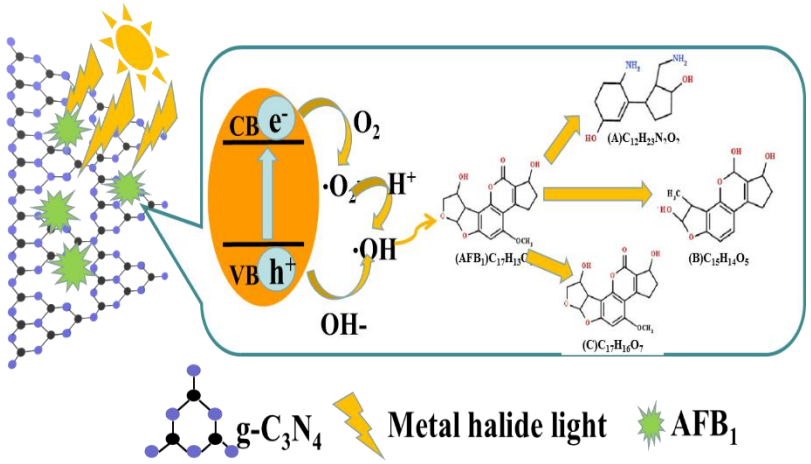
- Basic measures such as GAPs and Good Manufacturing Practices (GMPs) as aflatoxin preventive measures have proven effective when combined with proper postharvest handling practices
- At harvest, areas with different levels of risk of aflatoxin can be harvested earlier or separately.
- Scientific advances have also permitted the use of sophisticated physical, biological, and chemical, measures for the prevention and decontamination of already contaminated agricultural products



Control of AFB1 in our Lab

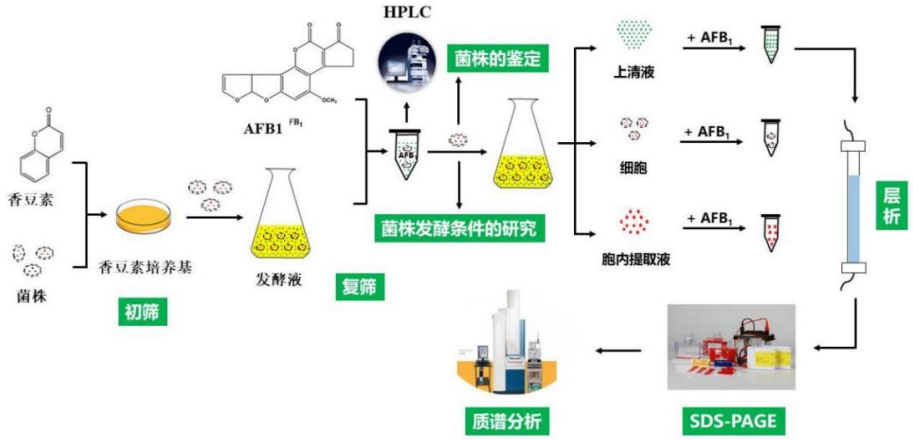
Physicochemical method

- Photocatalytic targeted degradation
- Low temperature plasma degradation



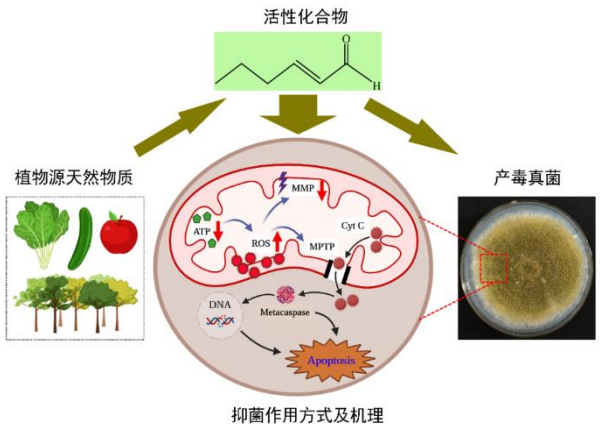
Microbial enzyme degradation

- The bacteria producing degrading enzymes were screened: Bacillus, Aspergillus terreus, etc



Natural compounds inhibit bacteria

- Natural compounds: chlorophyl aldehyde, paeonol, cinnamaldehyde, citral, thymol, etc



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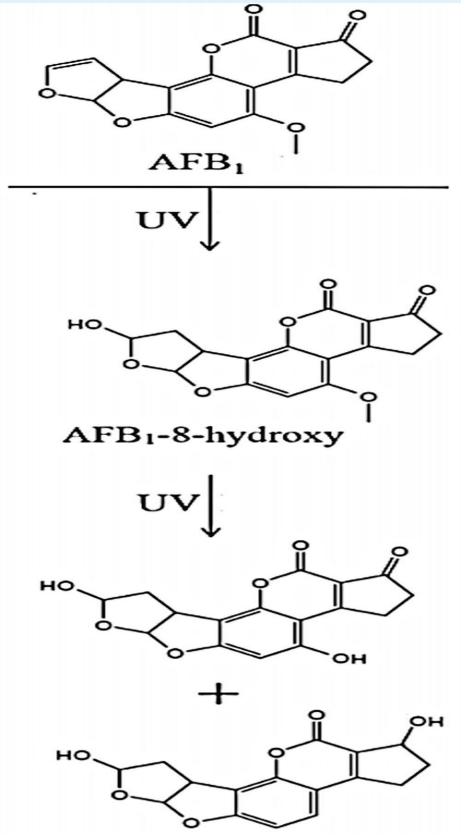
i) Irradiation

- Ultraviolet (UV) irradiation is a non-thermal alternative to thermal processes commonly used in food processing with a well-known effect on AFB1 degradation
- It has been established that AFB1 and AFG1 are the most sensitive to X-rays.X-rays are capable of producing a high issuance of energy, which causes the breakdown of stable molecular structures, hence AFB1 detoxification
- At a dose of 10 kGy, AFB1 degradation reached the highest values at 81.1 and 87.8% for corn and rice samples, respectively



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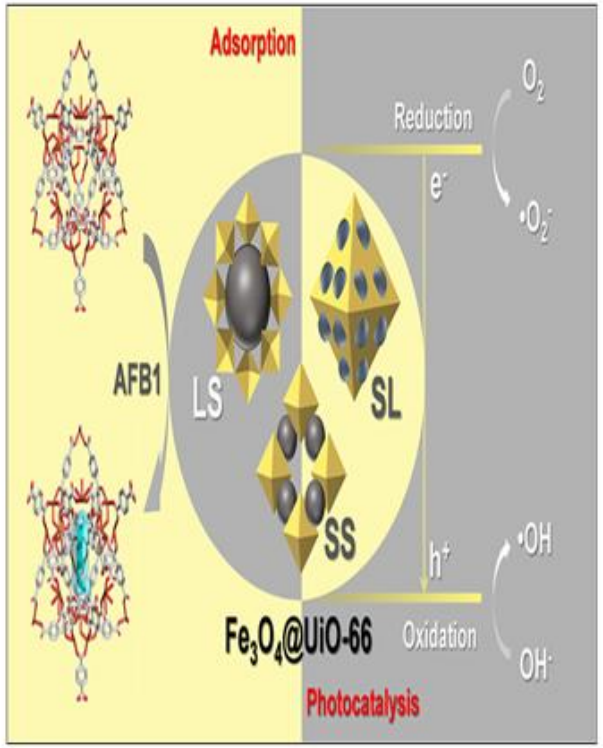
ii) Photocatalytic degradation

- Photocatalysis is regarded as a green, mild, and low-energy method of reducing AFB1
- Electrons and holes cause reduction and oxidation reactions in molecules (such as mycotoxins) that are adsorbed on the surface of the photocatalyst
- Ag-loaded titanium dioxide composites showed more than 90% inhibition rate against A. flavus under visible light irradiation for 15 min
- This method could also reduce the contaminated level of A. flavus to prevent aflatoxin production in maize



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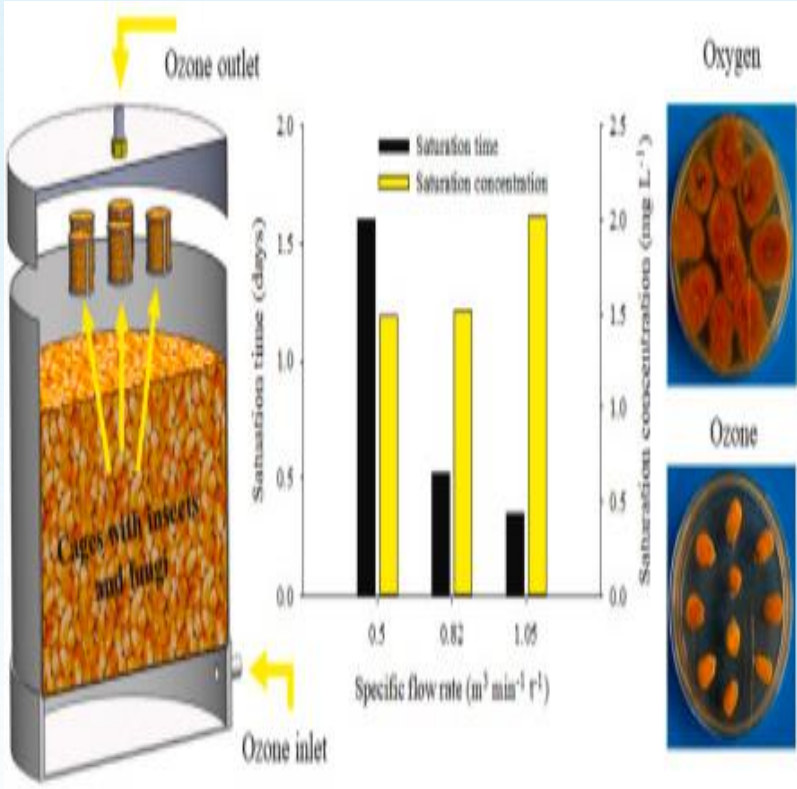
iii) Adsorbent detoxification treatment

- Adsorption is another physical method that involves the binding of toxin compounds, hence reducing AFB1 in food or feed materials
- A mycotoxin binder can be added to animal feed in small quantities in order to trap AFB1, preventing them from entering the bloodstream
- Examples of binder materials include: Silicates, Clays, Yeast, and Charcoal

Cont.…

iv) Ozone fumigation

- Ozone is a powerful disinfectant and oxidizing agent and is considered safe to be used in the food industry for the detoxification of chemicals or microorganisms
- Many literatures reported high rates of aflatoxin degradation with ozone.The mode of action involves its reaction with the C8 to C9 double bond of the furan ring of aflatoxin
- Ozone can significantly reduce AFB1 from 83 to 9.9 ppb i.e. 88% in corn with an exposure time of 40 minutes
- The efficacy of ozone increases with the level of contamination and the amount of time the product is subjected to the ozone



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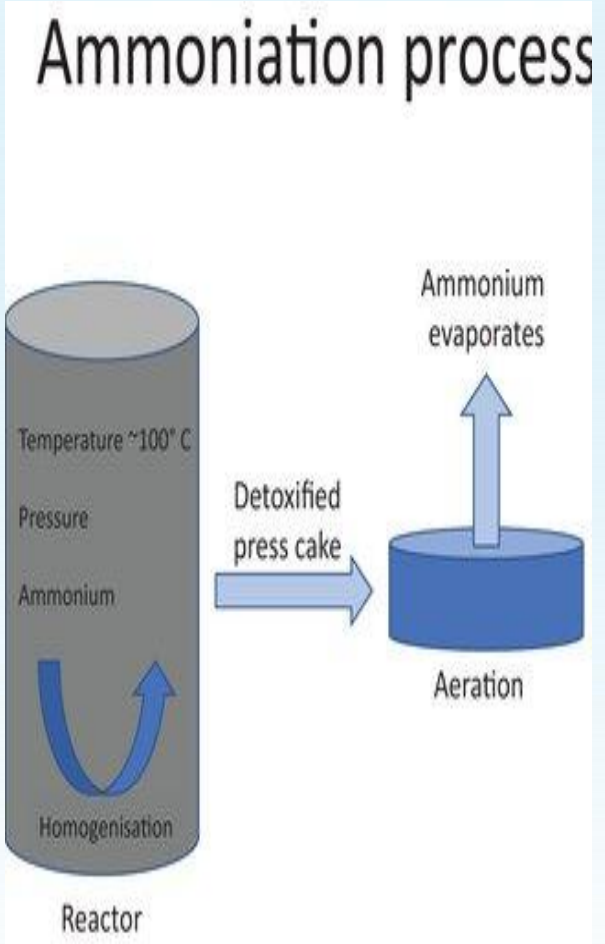
v) Alkaline chemical detoxification

- Alkalis is among the chemicals that have proved to mitigate the aflatoxigenic fungal growth and aflatoxin production when used in appropriate quantity
- Nixtamalization is originally from ancient Mexico and is applied to corn tortillas which largely destroys AFB1 in corn.It involves heating cereal grains in abundant limewater (CaOH2) and then steeping for 8 to 16 h before the solution is decanted
- The nixtamalization process is used to produce fresh dough or industrial flour.Traditional nixtamalization is capable of destroying 85% of the AFB1 present in maize
- Many reports have demonstrated that the nixtamalization process inactivated AFB1 by 85-95%

Cont.…

- Ammoniation is another alkaline-based treatment approach used to decontaminate aflatoxin in food products because aflatoxins are unstable under alkaline conditions
- The mechanism of ammonia and other bases against aflatoxin is opening the lactone ring in the toxin's chemical built-up reducing it to a less toxic substance
- Ammonia treatment is an extensively studied aflatoxin degradation technique often reported with high degradation rates



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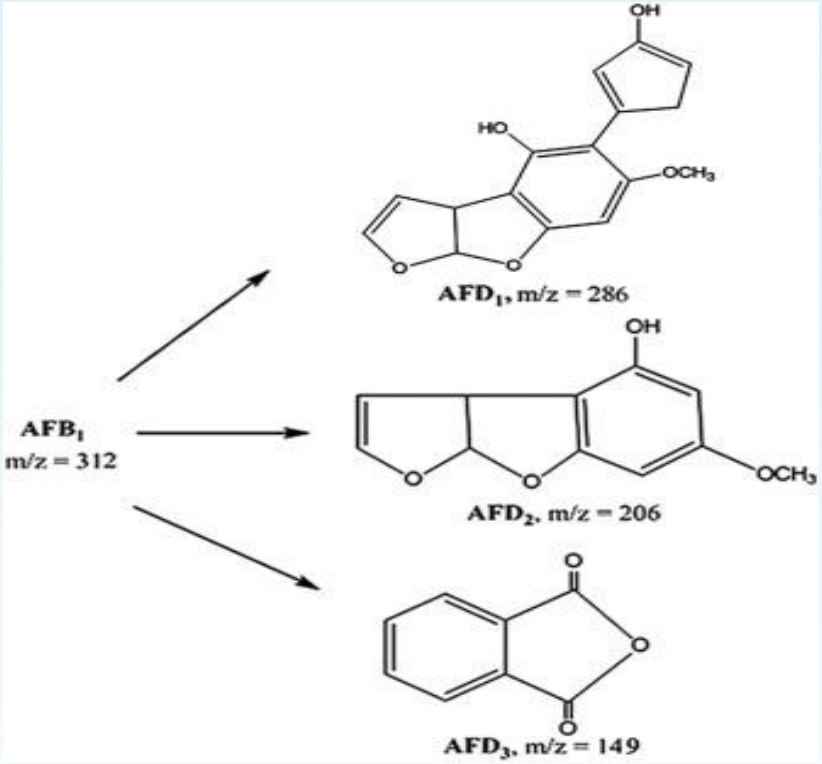
vi) Microorganisms or enzymes can degrade or metabolize mycotoxins

- Biological methods are believed to be less aggressive, environment-friendly, more specific, and cost-effective compared to other methods of detoxifying aflatoxin
- Several microorganisms produce enzymes that can degrade AFB1 and change the original structure of the mycotoxin into substances that are low in toxicity or even completely non-toxic
- Although many microorganisms can detoxify aflatoxins, probiotics are the first choice for detoxification
- Probiotics improve the rate of degradation of aflatoxins and make the intestinal epithelial barrier more resistant to mycotoxins and toxins from other pathogenic microorganisms

Cont.…

Degradation

- Microorganisms and their products remove aflatoxin through degradation into nontoxic compounds, surface adsorption, and inhibition of their bioavailability by binding
- *Streptomyces* sp. achieved 88% degradation and total elimination of genotoxicity in AFB1 without forming a new toxin
- During aflatoxin degradation, pH and temperature are essential parameters in the process



Adsorption

- Yeast could be another candidate for a probiotic against aflatoxin contamination as it has an excellent binding ability
- In addition to that is not new to the food industry
- A study reported a 95% reduction in aflatoxin levels without altering the organoleptic characteristics of milk using LAB
- The microbial binding process is mainly attributed to:-
  - ✓ Temperature, pH, incubation period,
  - ✓ strains of microorganisms, inoculum size,
  - ✓ product type, levels of contamination, and
  - ✓ the binding organisms' condition (viable or inactivated)