Risks presented in Brazil nuts

Aflatoxins:

Aflatoxins are a group of ~ 20 toxins produced by the fungi *Aspergillus flavus*, *Aspergillus parasiticus* and *Aspergillus nomius*. The most relevant toxins present in dried fruits and nuts are B_1, B_2, G_1 and G_2. The difference between them apart of the chemical structure is the level of toxicity they present.

Although it is not possible to see aflatoxin itself with the naked eye, it is possible to spot some of the defects that could indicate the presence of toxins, such as damaged tissue caused by the fungus. For example, in Bolivia, where the Brazil nuts are collected and processed, the kernels that present "chia" (a black dot on Brazil nut kernels caused by the attack of microorganisms when the nut is laying on the forest floor) are believe to be concentrations of aflatoxins. For this reason these nuts are removed during the process. However, these signs may not always be obvious. Due to this, it is difficult to determine the presence of aflatoxin without doing microbiological testing. It can be detected through tests using methods like the HPLC technique. At the same time aflatoxin can also be detected under a UV light at the factory.

For the fungus to grow in the different fruits and nuts it needs to have favourable growing conditions. This means a hot temperature, relative humidity > 70% and low water activity (<0.7). By controlling these conditions the growth of the fungus and production of the toxins can be restricted. Of course it is not possible to control these conditions as the Brazil nuts grow naturally and are collected in the middle of the Amazonas basin. However, good practices during and after collection can be a remarkable help to mitigate the risk of aflatoxins.

Taste Problems in Brazils

Taste:

The Brazil is one of the highest oil content nuts consumed. It is a wild grown nut, completely unstandardised. The oil is contained in bags within the cells of the nut. As the nut ages, or receives mechanical or thermic stress, humidity variations the oil breaks out of the bags and then the cells. This oil is now exposed to oxygen and it will oxidise and this is what rancidity is, this is the taste we dislike.

If you go to the forest, machete open a pod and then a nut producing a fresh kernel and taste it you will be surprised, the taste is very similar to a fresh piece of coconut. It has

sweetness and a freshness that is missing in the dried Brazil nut available in the shops. As they caramelise, the sweetness of the sugars becomes more like toffee, if we go further it can almost become bitter like burnt toffee.

The modern consumer being fed and encouraged to buy standardised pap is unable to countenance variations in flavour. When they come across something that varies from the mean, they assume that it must be "off". The requirement then, is for bland standardised tastes, nothing extreme.

The Brazil nut goes through several processes which shock it. All of these will affect the taste range.

Drying

When the raw material arrives it has to be dried in order to stabilise it. The cylindrical drier is fairly standard but the associated process of tempering varies. You can either shovel the heaps of brazils all day or you can have elevators moving the piles around or you can put them in huge silos, with internal thermic probes that can determine the temperature, you can use modern laser techniques to measure the temperature INSIDE the kernels and you can develop programs to run all this without human error.

Then you can cool it, you can air condition it. The finer control you have over your process the lower temperature you can work at and the less thermic shock you deliver to the kernel.

The difference is between a process which has its own internal checks and balances or a recipe driven system where chef knows best.

Autoclave

The Brazil nut kernels are pressure cooked prior to processing; here there is pressure and temperature stressing the nut. Again, you can monitor and control, as well as minimise the stress. But the more you cook the nut the less breakages you will get, the shell will separate further from the kernel , the more flexible the nut will be so less breakages and more skin will separate giving you a nice white nut. Pretty nuts may be burnt inside. Ugly nuts are tastier nuts.

Final process heating

No matter how dirty your factory is, all outgoing product is going to be clean as a whistle because of the final process, so give it a good long blast 9 hours at 80º C. Fine but if the kernels are a little small you may cook the nut too much. But that's not

a problem because you won't see that unless you cut the nut open and look. It won't taste so good; it will be a BROWN CENTRE.

The brown centre is a special case, the ground zero of Brazil nut processing. We feel that what happens is this: the outside of the kernel becomes like a bombshell, a crust containing the heat and the humidity. The inside becomes like a pressure cooker, the inside is thoroughly cooked, sugar caramelised.
Many factors must come together to make a brown centre and they can only be reduced not eliminated. It's a wild nut. To standardise it without killing it requires a lot of science and will always be a probabilistic exercise.

It is not necessarily old crop, it is not necessarily wet nuts, and it is not necessarily overcooked nuts.

Thermic shock and the hot pie effect these are the causes.

The ultimate cause of brown centres is the mismanagement of thermic stress. By this we mean any heat step involved in the process (autoclave, drying ovens). Inside the cells of the nut there are small pockets of oil and if this is not managed carefully and gradually then you have a kernel which has a bubbling cooking point in the centre. Therefore temperature control and standardisation is essential. Each pulse of heat applied to the product should be square, you need cooling after each application of heat otherwise product will continue in shock, especially in the centre of the nut. Any thermic in brown centres. There may be a number of necessary but not sufficient conditions such as humidity, mechanical stress, age etc.

Microbiological risk:

Brazil nuts are dried for 12-14hs. The maximum temperature they reach during the process is 75-80°C for 2 hours to guarantee the microbiological levels. If any failure of the ovens occurred and the failure goes undetected, it will then be detected during the quality control checks as the texture of the kernel won't be satisfactory and the moisture level would be higher than expected. Also, the microbiological analysis (which is done on every batch) would detect any abnormality in the product. Considering this, the risk of microbiological issues is very low.

Foreign bodies:

Foreign bodies that are most commonly found in the finished product are those that are present between the time of cracking and packing. The following are among the most common foreign bodies found in the finished product.

- Extraneous vegetable matters: the nuts in shell are cleaned trough sieves and aspirators to remove dust, leaves, strings and others foreign bodies that can be received with the raw material. Pieces of shell can mixed with the product when cracking but on the several following inspections it would be removed.

- Metals: metal nails and pieces of wire from the trays that are used to dry the nuts in the oven can be lost and mixed with the kernels. The magnets installed in each inspection table would detect this metals but it is still a critical control point in the process.

- Wood contamination: The frames used on the trays that go into the oven are made of wood, due to the changed in temperature it contracts and expand causing crack of the wood. Operators in the factory verify the conditions of the trays every day at start of the process.