Comparing processing operations and how these produce a different product that has a different purpose e.g. pompoms, fries, potato chips (same material but a different purpose)

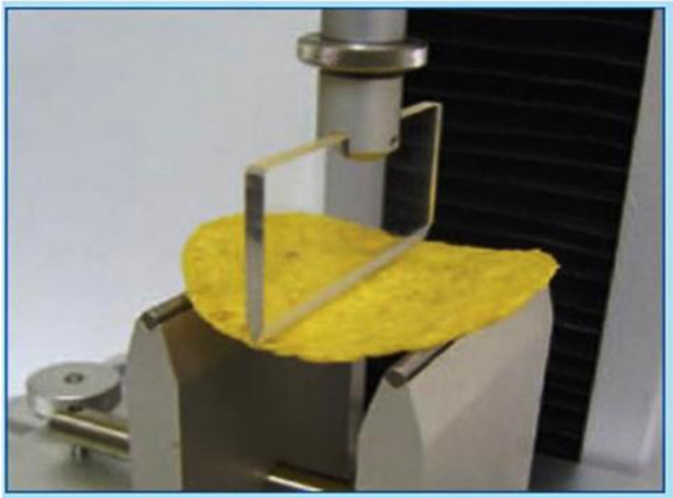
[1] Potato Pompoms have a fluffy interior. They are mostly potato, but also have vegetable oil, a pure starch (like cornflour, which is a pure starch) and flavours. The starch and protein in the potatoes is needed to help keep the mixture together, so a relatively starchy potato would be best to use. The oil needs to be part of the mixture to stop the proteins and starches in the potatoes from rubbing together too much and becoming gluey.
The potatoes are precooked to a point where, if punched with a fork they won't crack or fall apart. This would cause them to become too moist.
The potatoes should be processed just enough to break them down into small pieces. Processing too much can release too much starch, making the pompoms gluey.
The mixture should stay together when a clump is squeezed—if not, more starch needs to be added (ie cornflour).
The pompoms are par fried and then frozen. They need to be fried again before eating.
The desired colour is a dark, golden brown.
They are cut up into small pieces. The large surface area and craggy exterior (created from all the small pieces) makes them crispy on outside.

[2] The processing of **french fries** has some similarities and some differences (to pom poms).
One of the differences is that there is only one ingredient—so the potato itself has to achieve the desired effect. So the testing that is done to make sure pompoms are bound together doesn't need to be done when processing fries.
The potatoes used to make French fries need to have an ideal shape for the type of chip, and to be relatively free of blemishes, bugs etc (these need to be taken out). Some makers of fries use Russet potatoes—they have an oval shape which is good for making long fries. Smaller potatoes get made into fries that are ring or cubed shaped. Pom poms are made with bits of potatoes (they were originally developed to use up the disgarded bits of potato).
Potatoes like Russet are lower in sugar, which helps to get the crunch desired in fries. The lower sugar also keeps the flesh whiter for longer, a desired property when processing fries.
The picture opposite is of a rotational slicer that McDonalds use to make their long skinny chips.
Fries are generally soaked to leach out sugar, to help to ensure they all turn out same colour once they are cooked. The colour will be more obvious on a fry (particularly a straight one) than a crinkly pom pom.
The fries might also be blanched in hot and then cold water. This is to make the potato flavour more pronounced and to make the colour more even. A dextrose (sugar) product might be added to get a more even colour.
A computer can be used to analyse size and colour. Any fries that don't match the desired size and colour are blown off the production line by an air jet. These could then be further processed in to pompoms.
Testing for low moisture content is also important when processing fries, as too much moisture will inhibit the crispiness desired in fries.
Like pom poms, fries are also cooked again in fat before they are eaten.
Most fries are double cooked—firstly at a lower temperature to soften them, then at a higher temperature to crisp them up.

[3] Fries can also be triple cooked — this will give them a glass like crust on the outside and a soft, fluffy centre.

The fries are first simmered until when tested they almost fall apart. This is to ensure they attain a soft texture and so that the cracks that develop provide a place for the oil, which will harden (which makes the fries crunchy). They are then cooled and drained of water using a sous-vide technique (cooking in airtight plastic bags, like in the picture) or by freezing. Drying the fries drives out moisture that would otherwise keep the crust from becoming crisp.
They are then deep fried at a lower temperature (130 C) for 5 minutes and cooled. The aim is that any starch left in the surface cells dissolves and combines to create a rigid outer layer that can withstand the higher temperature of the final frying (180 C for 7 minutes). Just having a single frying at a high temperature can lead to a thinner crust that can get soggy by whatever moisture remains in the fries interior.

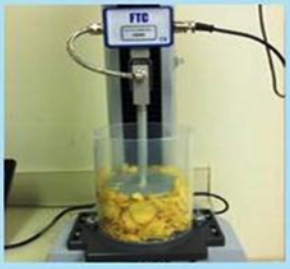
Discussing the implications of testing outcomes on processing decisions



The potato chip sample is supported at two points. The travelling beam moves down and snaps the sample.

[4] The snap test is done to determine the crispness characteristics of potato chips. For thin chips in particular, the crispiness is really important.

A machine is used to apply a force and to measure how the chip breaks. It is used to get an indication of what the frying profile should be, the cooking time, or that the moisture content of the raw product needs to be adjusted or the raw product needs to be soaked for longer to remove the starches. The goal is to get the chips brittle and dry.



It can also be used after packaging to determine the moisture migration (which will make the chips go stale).

This test can be used to determine the ideal sensory preference (ie too crisp, ideal, not crisp enough) during the development stage for a new product.

[5] For thicker chips, crunch (or hardness of texture) is really important.

This can be determined by a crunch test (see the picture on the left). This is done by a machine that simulates the chewing motion. The amount of chewing time is an indicator of the crunch. This is seen to be a far more accurate way of testing than relying on sensory testing. The results can be used to make adjustments to processes like the thickness of the slicing or the frying time. Adjustments might also need to be made to the moisture content of the potato before frying—production lines will use air dryers for this.