# Components of the Soy Bean

Soy is cultivated around the world and is stimulating the world market. It has become the most important plant-based protein source. Due to its nutritional components the soy bean has become very popular. Being used as an additive to various food products, soy ends up on people’s plates more often than they would know of.

You are working as a nutritionist and therefore need think about which nutritional components you would expect in the selected food samples. Test your hypotheses by carrying out the experiments. The results should be discussed and interpreted within the group before presenting them to the entire class. Connect your results with your knowledge about human nutritional habits and needs.

**Material**

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* Pens, Paper
* Computer and internet access
* Literature
* Plant material (frozen, fresh or dried soy beans, cereal seeds, fruit or vegetables such as apples, pears, potatoes, banana, etc.)
* Microscopes and equipment
* Small glass containers with lids
* Distilled water
* Sudan-IV staining solution
* Ethanol
* Coomassie Brilliant Blue staining solution
* Methyl acetate
* Lugol’s iodine
* Knives and cutting boards
* Glass cups
* Juice extractor
* Glass stick
* Coffee grinder
* Scale
* Centrifuge
* Folded filter
* Test tubes
* Merckoquant ascorbic acid test (from pharmacy)
* Combur 4 Test N (urine test strips from pharmacy)

**Carrying out the task**

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| 1. Considerations and Expectations | Plants play an integral part in human nutrition. Consider which nutritional components and compositions you would expect in the various plant materials. Compare the samples with each other. |
| 1. Experiments | Carry out the experiments as described in the instructions. Document your results. How did you achieve these results? Keep a research log. |
| 1. Interpretation | Describe the results from the experiments and compare them with the hypotheses you generated before. What are your results? Do they match your hypotheses? What could be the reasons for possibly different expectations? |
| 1. Human nutrition | Think about the significance of your results for human nutrition. Write an informative article for a popular magazine. |

**Experiment instructions**

Source: Brünoth, M. (2008). Nahrungspflanzen und ihre Inhaltsstoffe. Diplomarbeit. Universität Innsbruck

## Qualitative starch detection in food plants

**Material**: Microscope and equipment, tap water, Lugol’s iodine, plant material

**Aim**: A qualitative detection of starch using Lugol’s iodine’s staining effects.

**Safety precaution:** Be careful when working with Lugol’s iodine as it stains skin and fabrics!

**Instructions:**

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| 1. Preparing the sample | Prepare the sample by scraping cells from a freshly cut area of your object using a razor or lancet needle. Add the cells to a drop of water on a microscope slide. Try to indentify granules of starch (amylum) under the microscope. |
| 1. Staining | Add a drop of Lugol’s iodine to the edge of the cover glass and create a colour gradient by using filter paper to draw the liquid through. |
| 1. Observation | Observe the stains under the microscope. |

What do you observe?

Can you explain this observation?

Qualitative lipid and protein detection in food plants

**Material**: Microscope and equipment, small glass containers with lids, distilled water, plant material, Lipid detection: Sudan-IV staining solution, ethanol (destaining solution); Protein detection: Coomassie Brilliant Blue Staining solution, methyl acetate destaining solution

**Aim**: The qualitative detection of lipids and proteins in plants by staining them with a Sudan-IV solution and respectively a Coomassie Brilliant Blue solution.

**Safety precaution**: Be careful when working with methyl acetate (destaining solution) as it contains methanol which is hazardous to one’s health!

**Instructions:**

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| 1. Preparation | Prepare thin slices and examine them for lipid drops and proteins crystals under the microscope. |
| 1. Putting the solutions in containers | Lipid detection:  Add a small amount of Sudan-IV solution to a small glass container. Add the destaining solution to another glass container. Cover both with lids.  Protein detection:  Add a small amount of Coomassie Brilliant Blue solution to another container. Prepare a fourth container with destaining solution. Cover both containers with lids. |
| 1. Staining | Lipid detection:  Add a suitable sample slice to the Sudan-IV solution and transfer it into the destaining solution (96% ethanol) after approx. 15 min for differentiation.  Protein detection:  Add a suitable sample slice to the Coomassie Brilliant Blue solution and transfer it into the destaining solution (methyl acetate) after approx. 15 min for differentiation. |
| 1. Destaining | After a couple of minutes of differentiation, transfer the samples into distilled water on a microscope slide and observe the decolourisation under the microscope. |

What do you observe?

Can you explain this observation?

## Semi-quantitative detection of vitamin C, glucose and proteins

**Material**: Knife, cutting board, small cups, juice extractor, glass stick, coffee grinder, balance, centrifuge, folded filter, test strips, colour range, test tubes and holder, measuring pipettes, distilled water, plant material

**Aim**: The amount of vitamin C, glucose and total protein in food plants is to be tested semi-quantitatively by using test strips.

**Safety precaution**: Close the test strip container immediately to avoid contamination with other substances and to ensure durability.

**Instructions:**

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| 1. **Sample Preparation** (fruit and vegetables) | Cut the fruit and vegetables and extract their juice using a juice extractor.  Put the juice in a glass cup. In case its colour is to strong, dilute it with distilled water. Take notes of the ratio (e.g. 1:1, 1:4). |
| 1. **Sample Preparation** for cereal grains, seeds and nuts | Grind the seeds, grains or nuts with a coffee grinder or any other suitable gadget.  Weigh out a defined amount of it (e.g. 3g) into a glass cup and mix it with distilled water (e.g. 10ml). Let it sit for 15 minutes.  Filter the suspension with a folded filter into another glass cup. Instead of filtering it, you could also centrifuge it.  Put the filtrate into an empty glass cup. |
| 1. Vitamin C detection | Dip the test strip into the solution for approx. 1 second or press it against a freshly cut part of the fruit or vegetable for approx. 5 seconds.  Shake off any excess liquid. After 10 seconds, try to classify the colour shown in the reaction zone of the test strip by comparing it with the vitamin C colour range. |
| 1. Glucose- und Protein-detection | Dip the reaction zones of the test strips into the solution for approx. 1 second or press the test strip against a freshly cut part of the fruit or vegetable for approx. 5 seconds.  Shake off any excess liquid. After 60 seconds, classify the colours by comparing them with the glucose and protein colour ranges. |
| 1. Check and determine | Repeat the detection tests three times for each sample and write down the different concentrations. Finally, determine the mean value. |

What do you observe?

Can you explain this observation?