

Extracting pigments from leaf extract

Aims of the experiment

- Getting to know extraction as a purification process.
- Working with two-phase mixtures.
- Getting to know the density of different substances.
- Observing different solubility of substances more closely.

Principles

Extraction is the name of a process whereby a substance is eluted from a solid, liquid or gas using an extraction agent. The material from which a substance is to be eluted is also described as an extraction material. The extract, which contains the desired substance, and the raffinate, from which the substance has been eluted, remain at the end of the extraction.

Not all solvents can be used as extraction agents — they have to fulfil certain conditions. The solvent must only elute the desired substance from the extraction material and must at the same time be able to absorb large quantities of this substance. It should not chemically react with another substance in the extraction material. It should also be economical and easy to recover at the end. In the event of a liquid-liquid extraction, the extraction agent should not be able to mix with the extraction material or should do so only to a small degree.

Extraction is used as a purification process, usually when distillation or rectification cannot be carried out. Extraction is used in the organic-chemical industry, but also in inorganic-organic chemistry for releasing bauxite ore from iron oxide. Both the pharmaceutical industry and the cosmetic or perfume industry also use this process for recovering plant extracts.


In this experiment, an extraction is to be carried out by shaking. The extraction material is put into a separating funnel and an immiscible extraction agent (or one that is as immiscible as possible) is poured over it. Both phases are mixed together by shaking the separating funnel. The extraction material should build up in the extraction agent. After a brief waiting period, both phases separate again and can be drained from the separating funnel. This process can be used for eluting a desired substance from a substance mixture. It is used, for example, in synthesis, but also for removing undesired substances by washing.



Fig. 1 Set-up of the experiment.

Risk assessment

The leaf extract contains ethanol. There must be no open fire sources nearby.

Ethanol	
	<p>Hazard statements</p> <p>H225 Highly flammable liquid and vapour.</p> <p>Precautionary statements</p> <p>P210 Protect from heat/sparks/open flames/hot surfaces.</p>
Hazard	

Equipment and chemicals

1	Separating funnel, 250 ml, ungraduated	665 123
1	Stand base, V-shaped, large	300 01
1	Stand rod, 47 cm, 12 mm diam.	300 42
1	Bosshead S.....	301 09
1	Stand ring with stem, 100 mm diam.....	666 573
1	Rubber tubing 7 mm diam., 1 m.....	667 180
1	Scissors, 200 mm, pointed.....	667 016
1	Beaker, DURAN, 250 ml, squat	664 103
1	Graduated pipette, 10 ml	665 997
1	Pipetting ball (Peleus ball)	666 003
1	Safety gloves, neoprene	610 061

Additionally required:

cooking oil, leaf extract from experiment C2.4.2.1

Set-up and preparation of the experiment

Set-up of equipment

1. The equipment is set up as shown in Fig. 1.
2. Fix the stand rod using the stand base.
3. A bosshead S is attached to the stand rod, which is in turn used to fix the stand ring with stem.
4. Line the stand ring with three pieces of split rubber tubing of approximately 3 – 4 cm in length.
5. Insert the separating funnel in the stand ring and close with a stopper.

Performing the experiment

1. Check that the two-way stopcock of the separating funnel is closed and then fill a third of the funnel with the leaf extract from experiment C2.4.2.1.

2. Pour 2-3 cm of cooking oil over the extract.

3. Close the separating funnel with the stopper again and remove from the holder.

Note: The separating funnel should be held so that the stopper is fixed in the separating funnel with the right palm and the index and middle finger of the left hand are underneath the two-way stopcock.

4. Shake the mixture thoroughly. Stop shaking from time to time and briefly open the stopcock to ventilate.

5. Reposition the separating funnel in the stand ring to separate the two-phase mixture.

6. Once both phases have separated, place a beaker under the stopcock and drain the lower phase into the beaker by opening the stopcock.

Evaluation

To evaluate the experiment, the two extracted phases are compared with the leaf extract used previously.

Result

In this experiment, pigments are to be extracted from a leaf extract using cooking oil. The extraction is performed by shaking out the leaf extract with cooking oil. The liposoluble (lipophilic) pigments are absorbed in the oil phase. The insoluble (lipophobic) constituents remain in the ethanolic phase.

The liposoluble leaf pigments include carotenoids and chlorophylls. By eluting the liposoluble leaf pigments, the green colour of the alcohol extract becomes bolder. The oil phase also takes on a slight green hue.

Cleaning and disposal

Residual solvent must not enter the sewage system. It must be disposed of in waste containers, which are labelled as organic solvent waste. Extract which is no longer required must also be disposed of in the organic solvent waste.