Experiment: Detection of nitrate and chloride in soil from different locations (road, forest, field).

Question:

Does agriculture or traffic have an influence on the chloride or nitrate content in the soil and thus a harmful effect on the environment?

To test this, three soil samples are taken. One from a busy road (traffic), one from a field (agriculture) and the last from a nature reserve (control experiment, little influence from humans). These samples are then filtered and tested for nitrate and chloride ions, respectively.

Hypothesis:

If nitrate ions should be present in the soil samples, the nitrate test strip will discolor. If chloride ions are present, they will bind with the silver ions to form precipitate.

Material:

Coffee filter

Erlenmeyer flask

Spray bottle

Nitrate test

Funnel

Chemicals:

H_2O (aqua dest.)

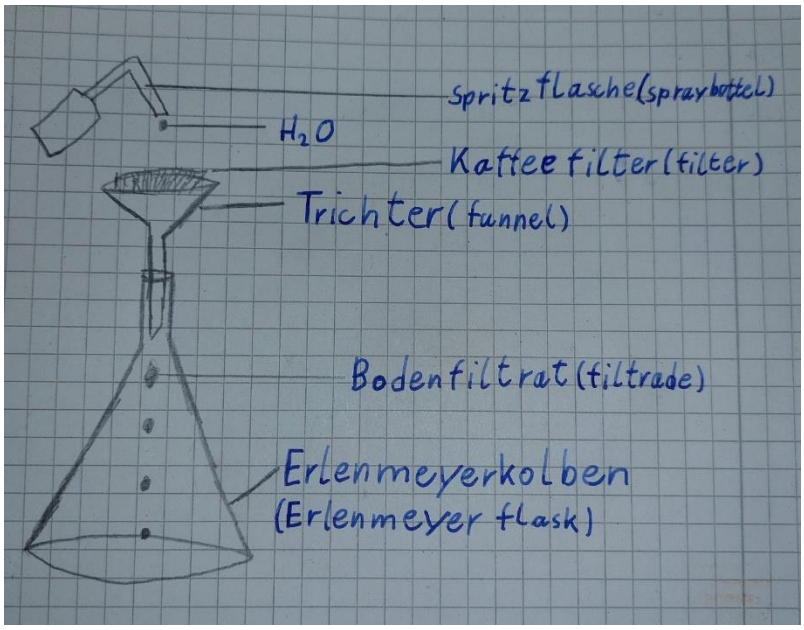
Soil samples

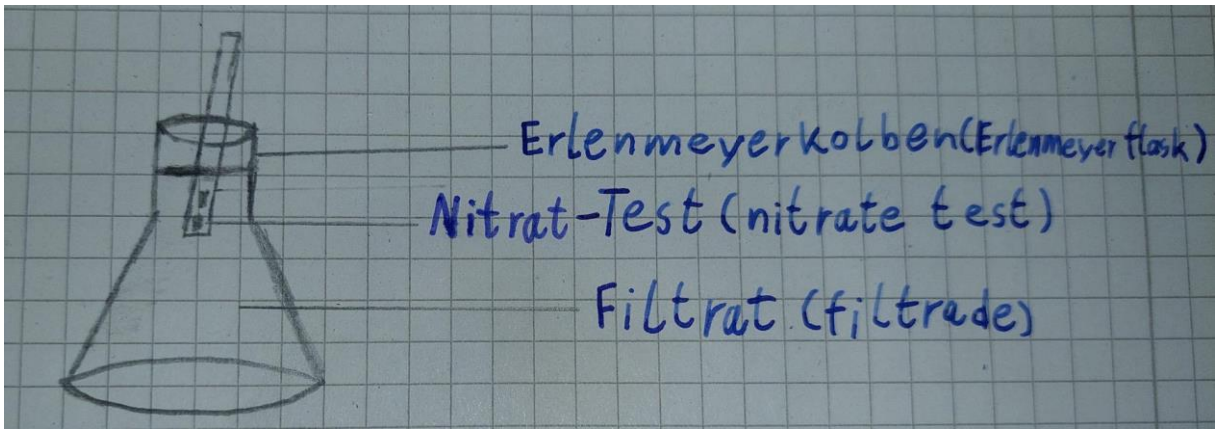
1.road

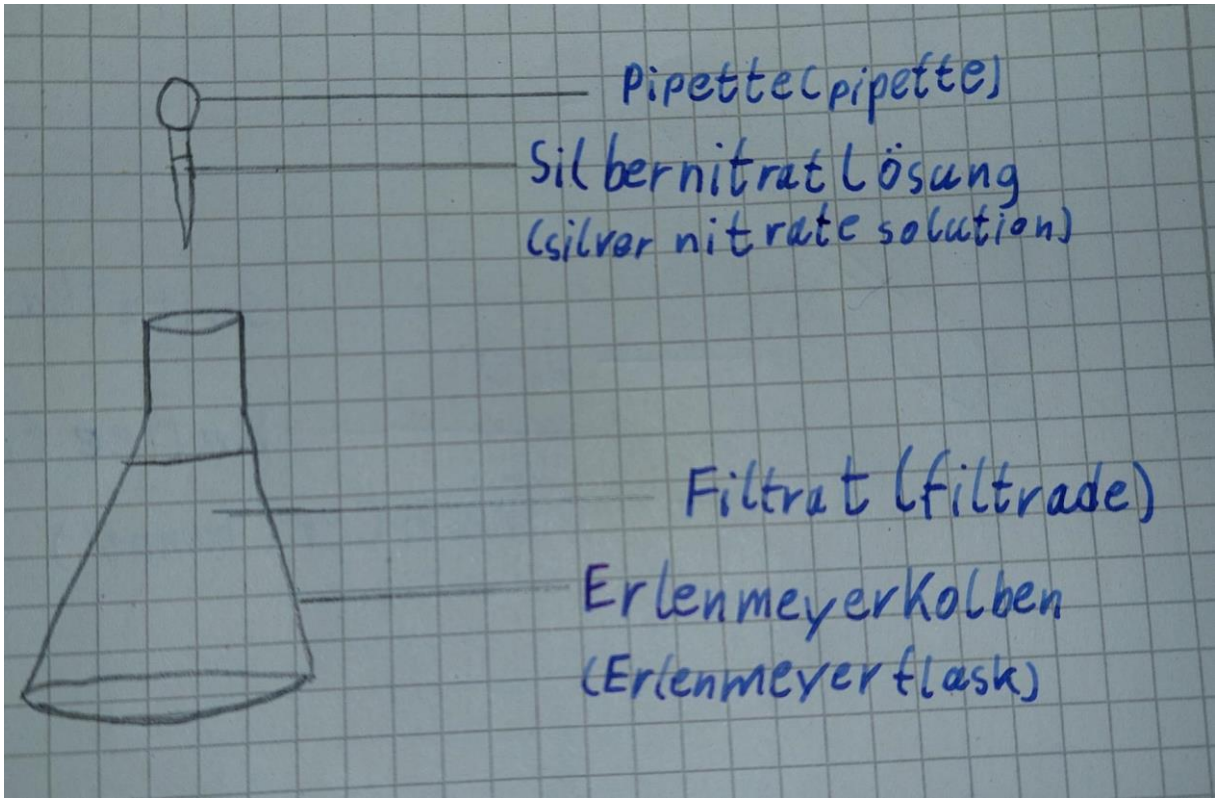
2.field

3.forest

Sketch:


Spritzflasche (spray bottel)
H_2O
Kaffeefilter (filter)
Trichter (funnel)
Bodenfiltrat (filtrade)
Erlenmeyerkolben
(Erlenmeyer flask)


Erlenmeyerkolben (Erlenmeyer flask)
Nitrat-Test (nitrate test)
Filtrat (filtrade)


Pipette (pipette)
Silbernitratlösung
(silver nitrate solution)
Filtrat (filtrade)
Erlenmeyerkolben
(Erlenmeyer flask)

Execution	Observation	explanation
1. filtration -Funnel and filter are placed in the Erlenmeyer flask -soil samples are mixed with H2O and gently swirled -sample is passed through filter construction	Forest: Filtrate clear/ transparent Street: Filtrate clear/ transparent Field: Filtrate brownish	Different soil composition
2.nitrate detection -Nitrate test strip is dipped into the respective filtrates -coloration is compared with the scale on the package -Nitrate value is read off	Forest: 25mg/l Street: 50mg/l Field: 10mg/l	middle amount of nitrate (Nitrification) big amount of nitrate (oxides of nitrogen) small amount of nitrate ()
3.chloride detection -Silver nitrate solution is added to the filtrates -chloride ions are present in case of precipitation	Forest: no precipitation Road: no precipitation Field: no precipitation	no chloride Ions

Photos

Filtrate



Forest



Street

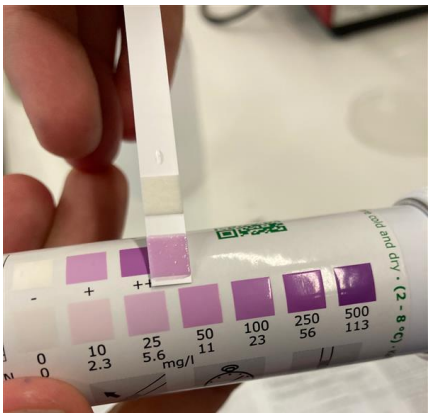


Field

Nitrate



Forest



Street



Field

Evaluation

Before considering the results, it must be made clear that only the top layer of soil (up to 10 cm) was taken. In addition, it must be noted that the soil composition of this top layer of soil plays a decisive role. The differences in soil properties have already become clear during filtration. The filtrate of the field sample is much browner than the others, suggesting that the soil particles are much smaller than in the other soil samples.

It is not surprising to find a measurable level of nitrate in all three samples. There are several reasons for this. In the forest, nitrate is probably produced primarily by bacterial nitrification. This is a natural and important process in the nitrogen cycle where nitrate is formed. On the road, vehicles and industry cause a high emission of nitrogen oxides. These substances are washed out by rain. In fact, groundwater, especially in urban areas, also shows (too) high nitrate levels. In the field, nitrate often enters the soil through the use of fertilizers, because nitrate promotes plant growth.

The high nitrate contamination on the road should be viewed critically, because a level of 50mg/l is very high. The limit value for nitrate in drinking water is 50mg/l. Ecosystems are even more sensitive to nitrate than humans. The low nitrate level at the field is surprising. Possibly the operator of the field does not use fertilizer or it is due to the soil conditions.

Since the nitrate content in the forest is 25mg/l and at the road the double content it can be concluded that traffic (and industry) has an influence on the nitrate content in the soil. In the field the nitrate content is only 10 mg/l, therefore it can be concluded that agriculture has no direct influence on the nitrate content in the soil, bearing in mind that only the nitrate content of the upper soil layer of a given field was measured.

There was no evidence of chloride in any of the samples. This can be explained by the fact that chloride occurs in deeper layers of soil or water.

Traffic and agriculture thus have no direct influence on the chloride content of the soil.

Possible sources of error:

The filtrate may have errors (contamination in the glass, etc., variation in soil properties, too dirty = precipitate not detectable).