**Short-term joint staff training event, Poland 17-20 December 2018**

# Regional Science and Technology Center

## 18.12.2018

## Workshop outline

**Subject:**

A talk about environmental problems, issues of coping with this issue in individual EU countries, exchange of views.

Guided tour of the exhibition.

Free time to take advantage of the exhibition itself.

**DESCRIPTION OF WORKSHOPS:**

The visit will starts with a science workshop, on which we present the issues related to ecology. The aim will be to show how the Science Center, through experiments, show young people the problems resulting from environmental damage. During the classes, we will carry out experiments related to the properties and type of soil and we will detect heavy metals (on the example of lead) in the soil sample. In addition, we will discuss the issue of air pollution and the problem faced by a larger urban agglomeration, the speech about SMOG.

**EXPERIMENTS:**

The aim of the experiments is to learn about soil properties, learn about the most common sources of contamination and realize that the soil can be degraded in connection with what should be protected and looked after. In addition, workshop participants will conduct physico-chemical experiments using techniques used in laboratories. Thanks to which they will find out that such a common component of nature, it hides many secrets, the discovery of which can be an extraordinary adventure.

# About reaction of various soil types:

## EXPERIMENT I:

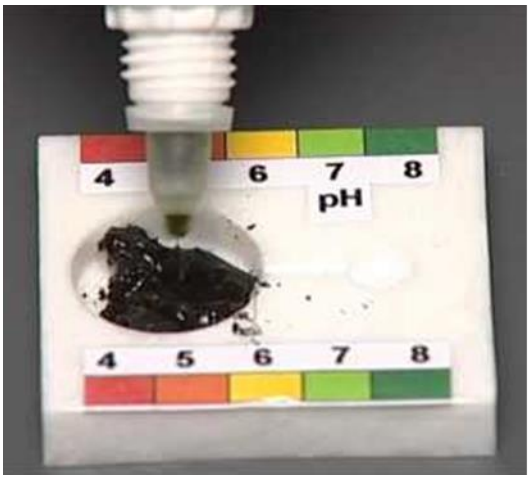
Required materials: soil samples: red, laterite, rice, brown, chernozem, soil acid meter, gloves, Hellig liquid, gloves

## The course of the experiment:

A small amount of each type of soil, pour into a round well on the acid meter plate (Fig.1)

Pour a few drops of Hellig liquid onto the soil sample (Figure 1)

The color of the obtained solution is compared with the color scale applied on the acid meter plate (Fig.2)





## Conclusions

| **Wartość pH** | **3,0** | **4,0** | **5,0** | **6,0** | **7,0** | **8,0** | **9,0** |
|---|---|---|---|---|---|---|---|
| odczyn | bardzo kwaśny very acid reaction | Kwaśny Acidic | umiarkowanie kwaśny mid acid | słabo kwaśny low acid | słabo zasadowy weakly alkaline | Zasadowy alkaline | silnie zasadowy strongly alkaline |
| | **gleby kwaśne acidic soils** | | | **gleby obojętne neutral soils** | | **gleby zasadowe alkaline soils** | |
| typy gleb soil types | gleba czerwona lateryt red soil laterite | | | gleba ryżowa rice soil | | gleba brunatna czarnoziem brown soil, mould (humus) | |

Interpretation of the results is simple because a scale is painted on the plate, with which we compare the color of the soil samples used during the experiment. A more accurate method of soil pH measurement requires the use of a pH meter.

Red soil, laterite (acid reaction) - it can grow on it: magnolia, cranberry, raspberry, heather

Chernozem, rice soil (neutral reaction) - it can grow on it: spinach, sugar beets

Brown soil (alkaline reaction) - it can grow on it: common lilac, common pasqueflower, pine

## Summary:

Knowledge of soil pH is necessary for proper fertilization that ensures optimal conditions for the growth and fruiting of plants. The acidity of the soil affects the nutrient uptake by plants, and hence the yield and soil and the size of the crops.

The workshop leader points to the next important property of soil development - sorption, ie the ability to retain / absorb solid, liquid and gaseous substances by soil particles through mineral and organic soil colloidal particles. This property allows the absorption of nutrients, mineral salts by plant roots, is also responsible for the retention of toxic substances in the soil and the regulation of pH.

### EXPERIMENT II

### Investigation of soil sorption properties.

Required materials: $KMnO_4$ aqueous solution, $CuSO_4 * 5H_2O$ aqueous solution, garden soil sample, funnel, conical flask, filter for coffee, blades, soil sample containers

## The course of the experiment:

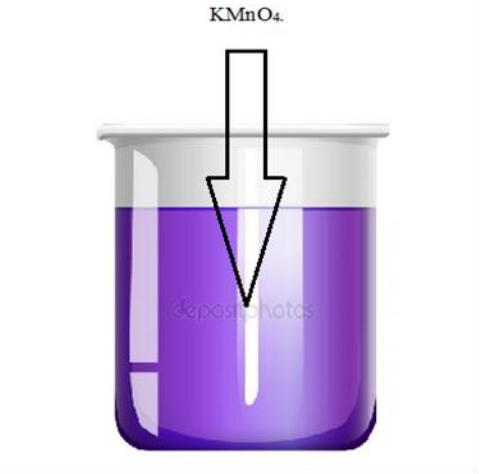
We prepare in a plastic beakers an aqueous solution of manganate (VII) potassium and copper (II) sulfate water1 / 5, by dissolving 50 grams of crystals of these salts in 150 ml of water (Fig.1, Fig.1.1)

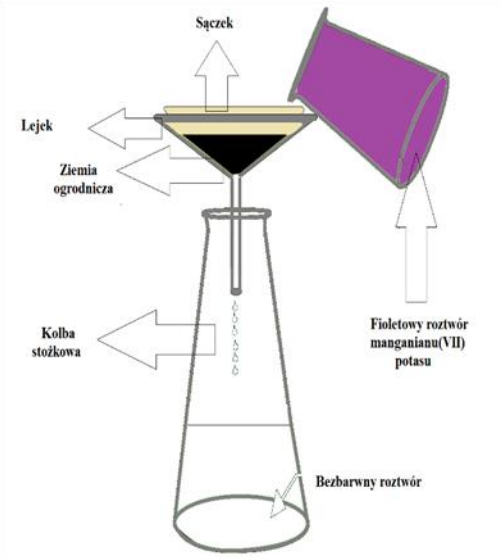
Put a glass funnel into the conical flask. (Fig. 3, Fig. 3.1)

Next, place a coffee filter in the funnel (fig.3, fig.3.1)

Using a spatula, put in a pre-prepared funnel, a soil sample.

We pour purple water solution $KMNO_4$ into the soil surface using beakers (Fig.3, Fig. 3.1)


## Observations

The water was purple at the beginning, after filtration it became transparent.

## Conclusions

Soil has sorption properties because the dye particles have been retained by it.

Soil sorption properties are used for fertilization. The soil stops and stores the nutrients from which the plant later uses.

In Poland, acidification of soils has been one of the most serious problems of agriculture for a long time. It is connected with a large share of light soils, climate and significant impact of anthropogenic factors. As a result of acidification, degradation of clay minerals occurs, which leads to the formation of unstable and defective soil structure, because due to the low content of calcium soil crumb easily breaks down under the influence of mechanical cultivation, which leads to its crusting and clumping during drought, and with excess rainfall makes them coarse. In acidic soils, the biological activation decreases, because such an environment affects the development of fungi and actinomyces, while it limits the growth of bacteria, especially those that co-exist with legume plants, enriching the soil with nitrogen. This may lead to the inhibition of many biochemical processes such as the decomposition of the organic substance substance.

In the soil there is moving aluminum, active manganese and easily soluble iron, the excess of which is toxic to plants,

weaker use of nitrogen, because when the acid is too acidic, plants take less nitrogen in the ammonium form, and in such conditions the nitrification process also decreases

increasing the mobility of heavy metals such as lead, cadmium, chromium and others that have toxic effects on plants,

He concludes that soil contamination is caused by various chemical compounds, radioactive elements and microorganisms found in the soil in increased amounts. All this affects the change of soil characteristics, which loses its natural properties, and thus, it can not be used normally.

| **RODZAJE ZANIECZYSZCZEŃ**<br>TYPES OF POLLUTION | **ŹRÓDŁA ZANIECZYSZCZEŃ**<br>SOURCES OF POLLUTION |
|---|---|
| metale ciężkie i toksyczne związki chemiczne (tlenki siarki, tlenki azotu, tlenki węgla, ołów, rtęć, kadm, cynk)<br>**heavy metals and toxic chemicals (sulfur oxides, nitrogen oxides, carbon oxides, lead, mercury, cadmium, zinc)** | pyły i dymy z hut, kopalni, zakładów przemysłu ciężkiego, energetyki, transportu, komunikacji<br>**dust and fumes from steel mills, mines, heavy industry plants, energy, transport, communication** |
| nawozy sztuczne, pestycydy (środki ochrony roślin), chemiczne regulatory wzrostu; środki czystości (detergenty)<br>**fertilizers, pesticides (plant protection products), chemical growth regulators; detergents (detergents)** | nieprawidłowe stosowanie nawozów sztucznych i pestycydów w rolnictwie, wymywanie z pól, ścieki z zakładów produkcyjnych i gospodarstw domowych<br>**improper use of chemical fertilizers and pesticides**<br>**in agriculture, leaching from fields,**<br>**sewage from production plants and households** |
| odpady stałe takie jak: popioły, żużle, metale, szkło, tworzywa sztuczne<br>**solid wastes such as ashes, slags, metals, glass, plastics** | hałdy kopalniane, składowiska odpadów, substancje szkodliwe są wypłukiwane przy nieprawidłowym zabezpieczeniu<br>**mine heaps, landfills, harmful substances are washed out with incorrect protection** |
| Zakwaszenie<br><br>**acidification** | opady kwaśnego deszczu, procesy biologiczne, nieracjonalne nawożenie<br>**Acid rainfall, biological processes, irrational fertilization** |

EXPERIMENT III

DETECTION OF HEAVY METALS IN SOIL:

lead detection in soil

Required materials: soil sample, conical flask capacity 200ml, glass funnel, filter paper, potassium iodide solution, baguette, 250ml beaker.

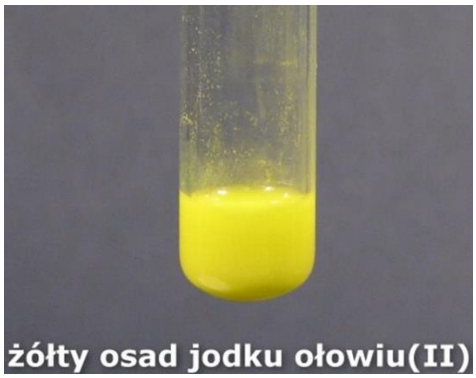
## The course of the experiment:

Put a glass funnel in the flask and place the filter in it.

Put a sample of water on the filter

Pour the potassium iodide solution into the funnel and observe the filtrate

Found images for query lead detection in soil




### Observations and Conclusions:

1. Yellow precipitate, light precipitate = there are traces of lead
2. Smallest turbidity = trace amounts of lead

The amount of lead in the soil depends on its location

The reaction: $Pb(NO_3)_2 + KJ \rightarrow PbJ \downarrow + 2NaNO_3$

## SUMMARY OF EXPERIMENT:

Lead is a very toxic metal.

The sources of lead contamination are, above all, industry and transport.

Lead emitted by cars gets into the human body not only through the respiratory tract but also through the skin and contaminated food.

The lead is made of: battery plates, equipment for the production of sulfuric acid, drainage sewer pipes, shields of electric cables, shots, elements of bullets ..