NATIONAL LABORATORY OF
HEALTH, ENVIRONMENT AND FOOD

National Laboratory of Health, Environment and Food

is the **central and largest** Slovenian **public health laboratory** that handles

- environmental protection,
- diagnostic and public health microbiological activities,
- chemical and microbiological analyses of different types of samples,
- performs research activities.

Health, environment, and food are our concern.

NATIONAL LABORATORY OF HEALTH, ENVIRONMENT AND FOOD

PESTICIDES IN DRINKING WATER Health Risk Assessment for exposure via drinking water

Contamination of drinking-water is a significant concern for public health throughout the world. Identification and assessment of chemical risks to health from drinking-water relies on analysis of water samples, whereby chemicals of potential local or national concern are distinguishing from long list of chemicals of possible significance – chemicals that are likely to occur in drinking-water at concentrations near or exceeding guideline values are identified as chemicals of potential concern (CoPc).

Guideline values for chemicals in drinking-water are set by Slovenian legislation (Regulation on drinking-water). Screening values are not risk based – they are based on existing guideline values for drinking-water from Europe (The drinking-water directive).

In Slovenia the quality of drinking-water is according to the Slovenian and EU legislation controlled in two ways (internal and external control). External control is ensured by the State with a monitoring programme – the quality of drinking-water is assessed making analysis of drinking-water samples taken from the final point of use of drinking-water - the pipe. About 3.200 samples are analyzed annually.

According to the data from drinking-water monitoring programme on some locations specific chemicals occur in drinking-water at concentrations near or exceeding guideline values (depend on the presence of their potential sources and on the size of the water supply system) - in 2020 less than 5 % of samples. Mainly pesticides are identified as CoPc above all in areas where agricultural activities are the main and almost only use of land and with small or medium sized water supply systems.

To assess health risk for chemicals identified as CoPc health risk assessment for the exposure via drinking-water must be done with different conceptual models which identify the distribution of chemicals on site, relevant receptors (bottle-fed infants, children, all population, elderly), exposure points and pathways and also toxicological profiles of CoPc. Health risk assessment for diferent popullation groups exposed to CoPc via drinking-water in 2020 showed that risks are adequately controlled / acceptable.

So far urgent risk management measures for pesticides exceeding guidelines values are not needed for now. The only risk management measure which should be considered is good risk communication about the health risk (no or low risk!) of pesticides in drinking water and about the importance to take some risk management measures despite of low risk now to ensure good quality of drinking water in the future.

For the future efforts should be made mainly to remove sources of pesticides in drinking water like forcing residents living in the water protection areas and others (industry, farmers,…) to strictly follow Decrees about the water protection areas in our country. Also forcing farmers in the water protection areas to change their way of farming in the future (seeding other cultures, change agricultural fields into grassy ones, bio farming…) is important.

If the removal of sources fail small and medium sized water supply systems should join in larger one wherever it is possible, water treatment techniques for removal of pesticides from drinking water should be assessed and regular control and review of the quality of drinking water must be implemented.

Vesna Viher Hrženjak

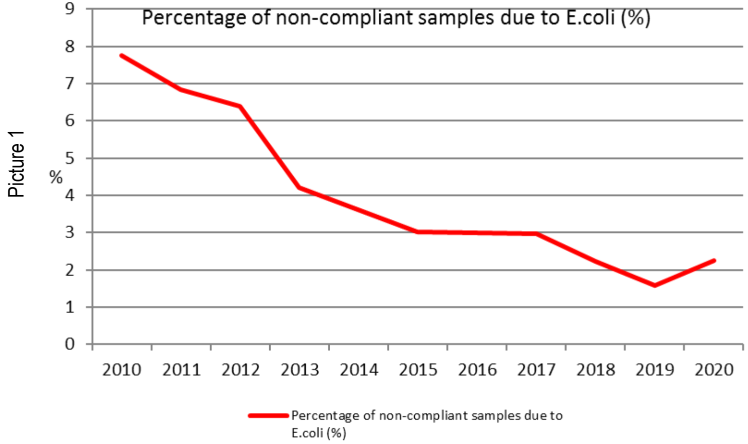
MONITORING OF DRINKING WATER IN SLOVENIA

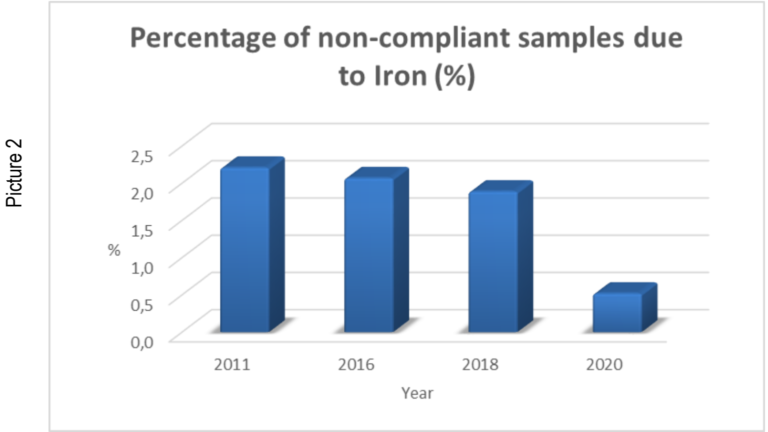
Drinking water is being monitored in Slovenia in accordance with the Rules on Drinking Water (Official Gazette of the Republic of Slovenia, No. 19/2004, 35/2004, 26/2006, 92/2006, 25/2009, 74/2015 and 51/2017) in order to protect human health from the harmful effects of any pollution of drinking water.

The provider of monitoring is the National Laboratory of Health, Environment and Food (NLZOH). **Monitoring programme** is prepared annualy and defines sampling points, sampling frequency, sampling methodolgy and physical, chemical and microbiological tests. The results of drinking water monitoring are tracked in the Drinking Water Monitoring Information System (MPV IS). The providers of measurements and testing report the results to the IS MPV through their laboratory information systems.

Drinking water tests provide important information about the state of environment in which we live and the water we drink. In the period from 2004 to 2021, we noticed a marked improvement in the quality of drinking water. Monitoring of drinking water is among the factors that have contributed to good results.

- In 2010, bacteria of faecal origin were detected in 10% of samples, while this share is currently 2.2%. (Picture 1)
- Chemical consistency of water is achieved in 98% of samples. In 2011, iron in water were detected in 2.21% of samples, while this share is currently 0.52%. (Picture 2)





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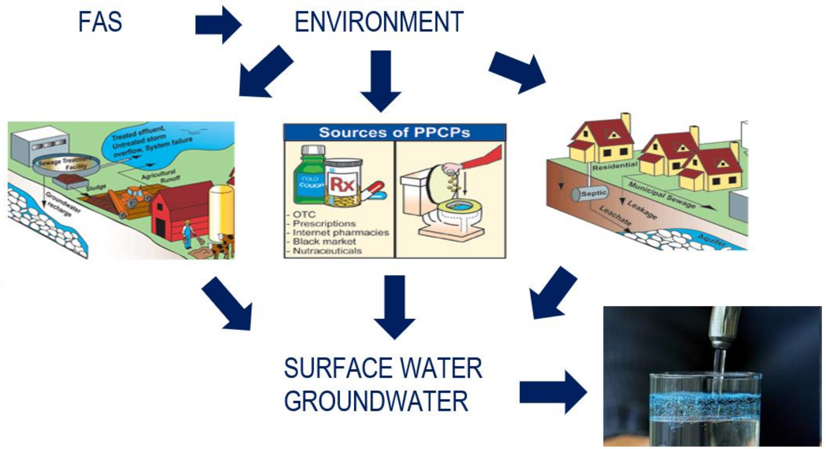
PHARMACOLOGICAL ACTIVE SUBSTANCES IN THE WATER SUPPLY SYSTEM OF URBAN ECOSYSTEM

BACKGROUND: Pharmacological active substances (FAS) are complex molecules with very different functional, physical – chemical and biological properties. Numerous researches, which have been carried out in different parts of Europe and in the USA have shown the presence of FAS in waste and surface waters, in underground water and also in drinking water and FAS have been recognized as an important factor of risk in the environment.



AIM OF THE STUDY: To define the presence of FAS and residues in the water cycle of the water supply system of medium-sized city (surface water, groundwater, waste water and drinking water) as an Example for Urban Ecosystems.

METODS OF WORK: Samples of surface water, underground water, waste water and drinking water have been taken at the area of the city and analysed with LC/MS/MS for the presence of selected FAS or their residues.

RESULTS AND CONCLUSIONS: In some samples taken in different parts of the water cycle five pharmacological active substances have been found - caffeine, carbamazepine, paracetamol, sulfametoksazol and theophyllin. The presence of FAS in surface and underground water represent a long-term potential danger for the environment and also for human.

Type of water	Carbamazepine	Caffeine	Paracetamol	Sulfametoksazol	Theophylin
	µg/l	µg/l	µg/l	µg/l	µg/l
Gound water	0,08	0,06	<0,05	<0,05	<0,05
Ground waterr	<0,05	0,07	<0,05	<0,05	<0,05
Surface water	<0,05	<0,05	0,16	<0,05	<0,05
Drinking water	<0,05	<0,05	<0,05	<0,05	0,07
Waste wate - inflow	<0,05	<0,05	0,22	0,09	<0,05
Waste water - outflow	<0,05	<0,05	0,06	<0,05	<0,05
Surface water	<0,05	<0,05	<0,05	0,06	<0,05

Project : "Transitional resource – Reorganisation of health care institutions and laboratories in the field of chemical safety", CRIS 2006/018-158.05.01.01.

Vesna Viher Hrženjak

Implementation of URBAN WASTEWATER MONITORING during the Covid-19 epidemic

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Wastewater contains different types of pollutants (chemicals, wastes, pathogens etc.) which must be properly eliminated before release into the environment.

The outbreak of the Covid-19 epidemic is increasingly considering the control of viruses in raw wastewater. The virus is excreted through saliva, urine and faeces from the human body, so by monitoring the quality of wastewater we can obtain important data on the virus's hotspots – an analysis of the trend of infections.

Urban wastewater represents a complex matrix of suspended substances, colloidal, biodegradable substances, nutrients and pathogens. In the sewage system, urban wastewater is diluted with industrial and rainwater, so the chance of survival of the virus is reduced. The introduction of SARS-CoV-2 virus from municipal sources passes through the sewage system. Among the busiest sewer systems are internal sewerage systems of hospitals and nursing homes.

SARS-CoV-2 virus is characterised by the fact that it does not reproduce outside the host and the concentration of the virus represents the state of the human population covered by a particular treatment plant. The persistence of the virus depends on the composition of the water, its temperature and pH. As temperatures rise, the activity of the virus decreases.

The tertiary treatment process (disinfection procedures – hydrochloric acid, peracetic acid, UV light...) has been shown to reduce the presence of SARS-CoV-2 in wastewater. Chemical disinfectants include free chlorine, the most effective means of destroying the virus, but it is necessary to measure/control the amount of chlorine on effluents, as excessive use of disinfectants affects the environment.

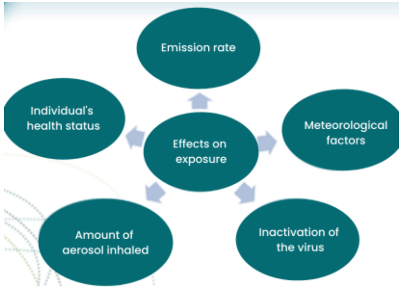

Figure 1: Effects on exposure to the virus

The effects on exposure to the virus vary (Figure 1). Ensuring adequate hygiene conditions and the use of adequate protective equipment is essential for the prevention and protection of human health. People who are exposed to raw/untreated urban wastewater are most at risk. Maximum potential human exposure on the treatment plant during the release of aerosols from the ventilation systems of wastewater.

In the context of operational monitoring of wastewater, in addition to general pollution, we could identify hotspots more quickly, spread or decline of pathogens in individual places. Based on measurements and analyses of the basic parameters of CK and BP5, we can conclude on the increased presence of pollutants. To determine more precisely the identity of the pollutant, appropriate chemical and microbiological tests should be carried out.

Graphs 1 and 2 show data on the measured concentrations for the CK and BP5 parameters in raw wastewater (inflows) of accidental treatment plants. The treatment plants are of different sizes (PE) and consequently clean different amounts of wastewater, which affects the concentration of the parameters measured. A comparison of these parameters for 2019 and 2020 is shown, i.e., before and during the epidemic. The graphs show that the concentration of parameters during the epidemic (2020) is higher, which can be concluded, on the higher content of pollutants (viruses, increase in drug consumption, food supplements, various cleaning agents, chemicals...) than in 2019. However, for certain treatment plants, we see a decrease in parameter concentrations. These can be attributed to the inflow of small quantities of industrial and municipal wastewater per treatment plant due to a reduced economy, tourism...

Although no proliferation of infections through the resulting wastewater has been observed in previous studies, protective equipment should nevertheless be used at the time of exposure and the recommendations of official institutions should be considered.

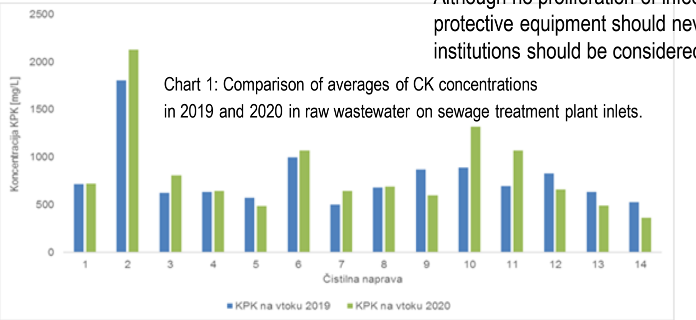

Chart 1: Comparison of averages of CK concentrations in 2019 and 2020 in raw wastewater on sewage treatment plant inlets.

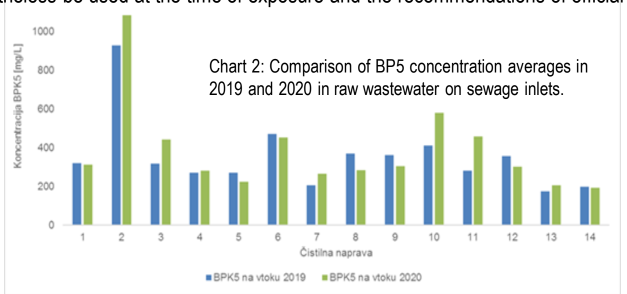

Chart 2: Comparison of BP5 concentration averages in 2019 and 2020 in raw wastewater on sewage inlets.

Anja Palko, Tatjana Jurša

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MICROPLASTICS IN AQUATIC ENVIRONMENTS

MICROPLASTICS - small pieces of plastic, <5 millimeter:

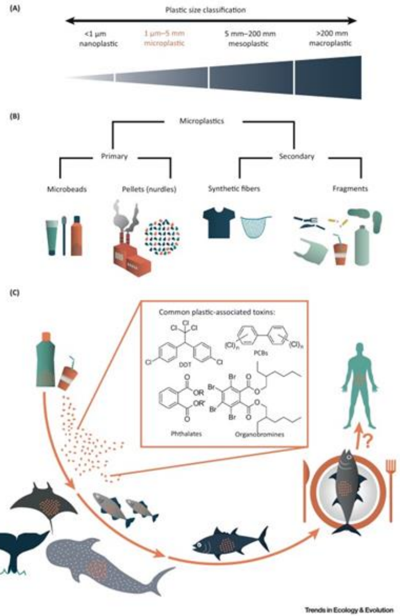
a) designed for finished products

b) due to mechanical transformation - environmental degradation (weather, sunlight, physical stress) of larger pieces of plastic

PROPERTIES:

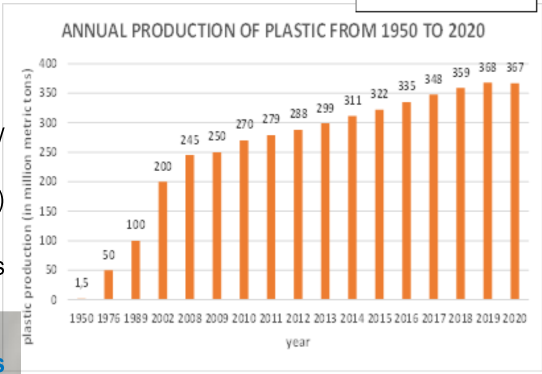
- light and durable
- can travel long distances
- is not biodegradable
- represents a vector for the transport of lipophilic and toxic substances (POPs, organochlorine pesticides (DDT) and analogues, PCBs, PBDE flame retardants, and lipophilic substances are also other bioacumulative and toxic substances

1950 - 1,5*10^6 tons
1976 - 50*10^6 tons
2010 - 270*10^6 tons
2018 - 359*10^6 tons
2020 - 367*10^6 tons



ADVERSE EFFECTS OF MICROPLASTICS ON HUMANS AND ORGANISMS:

- physical blockage and damage to the digestive system
- the exotheration of chemicals from ingested microplastics into the organism
- accumulation of chemicals in the organism
- particles up to 240nm are able to switch to planceta, thrombosis and various cell damage may occur
- potentially harmful chemical additives (phthalates, BPA and polybrominated diphenyl ethers) could be transferred directly from plastic to humans
- microplastic particles in drinking water of less than 150 micrometres can absorb and pass through the intestinal wall, reaching other tissues.

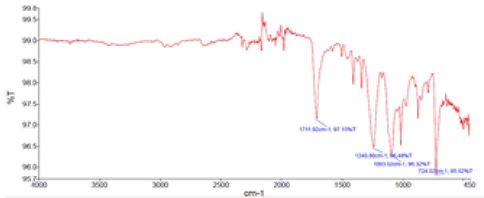


DETERMINATION PROCEDURE:

- taking samples
- removal of organic matter (HNO3, bases (NaOH, KOH), oxidation, enzymes)
- particulate separation
- FTIR-ATR –(Fourier transform IR spectroscopy – attenuated total reflectance.)

FTIR-ATR (spectroscopic method) allows particle determination from 10 µm:

Each polymer has its own spectrum of fingerprints, so it is possible to, by comparing spectra, to separate natural materials from polymers.



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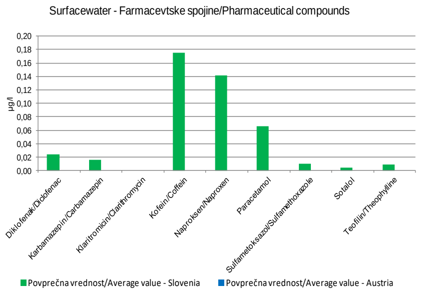
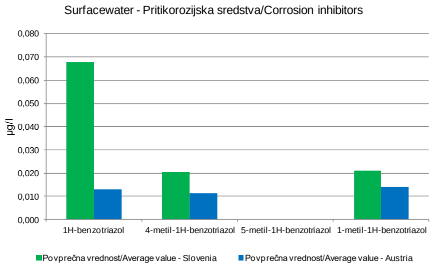
CROSS-BORDER RI(VER)-CHARGE PROJECT IN 2021

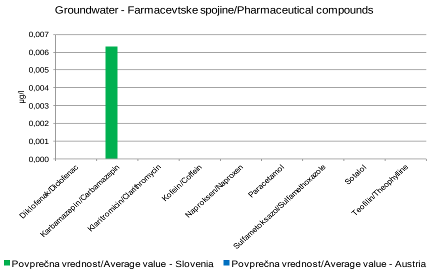
Interreg
SLOWENIEN – ÖSTERREICH
Europäische Union | Europäischer Fonds für regionale Entwicklung

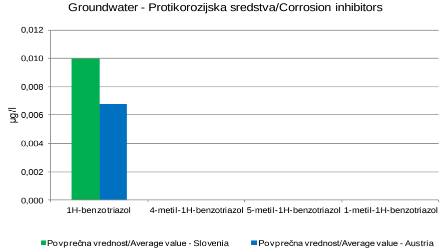
PURPOSE OF THE PROJECT: to examine, together with partners from the Austrian Styria, the effects of surface affluents from the western Styrian-Slovenian Edge Hills on the quality of surface water and groundwater. The main purpose was to find sources of detected anthropogenic pollutants (pharmaceutical compounds, corrosion inhibitors).

RESULTS OF SURFACE WATER AND GROUNDWATER SURVEYS (NLZOH):



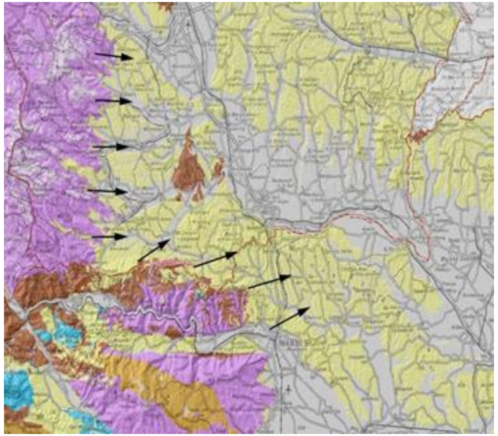






FINDINGS:

- **Surface water** is more burdened with anthropogenic pollutants than **groundwater**.
- The measured concentrations of residues of pharmaceutical compounds and corrosion inhibitors are generally higher in surface water and groundwater on the Slovenian side compared to surface water and groundwater on the Austrian side, e.g.:
  - **Groundwater** - Carbamazepine/Carbamazepine: MAX value – SLO = 0,17 µg/L, MAX value – AUT = 0,005 µg/L,
  - **Surface water** - 1H-benzotriazole/1H-benzotriazole: MAX value – SLO = 0,62 µg/L, MAX value – AUT = 0,066 µg/L.



ALLERGENIC POLLEN MONITORING IN SLOVENIA

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Pollen is among the first identified and important triggers of allergic asthma and rhino-conjunctivitis. The pollen grains of anemophilous plants represent a major problem for sensitised patients as they often are emitted in large quantities, may travel long distances and may affect individuals who are far away from the pollen source.

We upgrade the quality of our routine work by developing the profession, informing the public about pollen levels, and offering short-term forecasts, information and tools that help users implement preventive measures and understand allergic diseases.

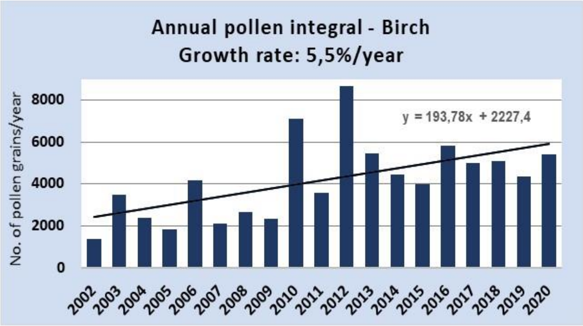

Fig.1. Annual pollen integral for birch in Ljubljana.

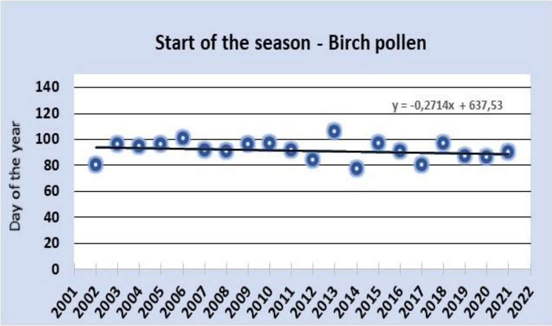

Fig.2. Start of the birch pollen season in Ljubljana.

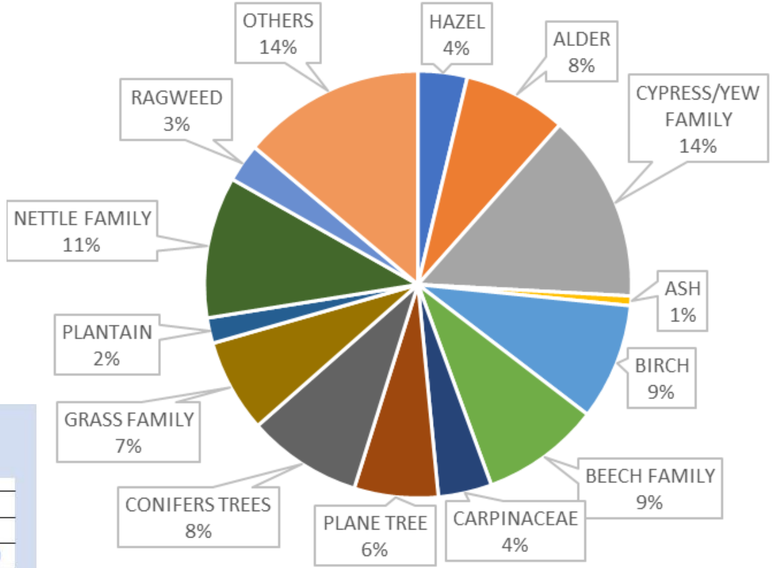

Fig.3. Pollen spectrum for Ljubljana, year 2019.




Andreja Kofol Seliger, Anja Simčič

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ULTRAFINE PARTICLES (UFP) AND BLACK CARBON (BC) IN SLOVENIAN URBAN AREA AMBIENT AIR

Project UFIREG Ultrafine Particles: an evidence-based contribution to the development of regional and European environmental and health policy

Ultrafine particulate matter (UFP), less than 0.1 µg or 100 nm in size, are smaller than regulated PM10 and PM2.5 and are believed to have more severe health implications. UFP occur from anthropological sources and naturally. The main exposure and health risk is through inhalation.

Black carbon (BC) is component of fine particulate matter (≤2.5 µm) which is formed through incomplete combustion of fossil fuels and biomass. It causes human morbidity and premature mortality and is also contributing to global warming by absorbing sunlight.

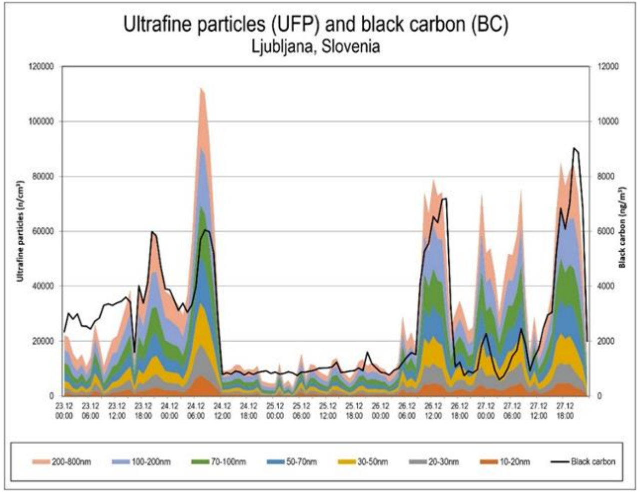

Figure: Time related occurring and size distribution of UFP and BC in Slovenian urban area ambient air (left) and air above urban area in winter (right)

Matevž Gobec, Uroš Lešnik