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Co-chairs: Julián Blasco, Antoni Ginebreda, Damià Barcel
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Risk reduction of chemical residues in soils and crops – impact due to wastewater used for irrigation (RESIDUE)

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1. Introduction

The current project is a cooperation of 5 partner from 4 European countries under the PRIMA research programme. It started in August 2020 and we are going to present the project concept and first project results.
The main goal of the project is to improve the safety of agricultural products grown in countries, which are obliged to use waste materials for irrigation and fertilization in agriculture. The concept of the project is not to set limits for this practice but to develop a technology with significantly reduced risks of transfer of organic contaminants into the agricultural products. The new technology will be based on i) the improvement of soil functions to enhance in situ the removal and detoxification of introduced organic pollutants, (ii) new production procedures for safe soil amendments and iii) a clear discrimination of non-bioavailable organic pollutants introduced into soil that do not constitute a risk for agriculture.

The scheme in Figure 1 shows sources and pathways for the occurrence of anthropogenic organic contaminants in the agricultural environment and their distribution paths in the related agro-ecosystem when utilizing biosolids and treated wastewater in agriculture:

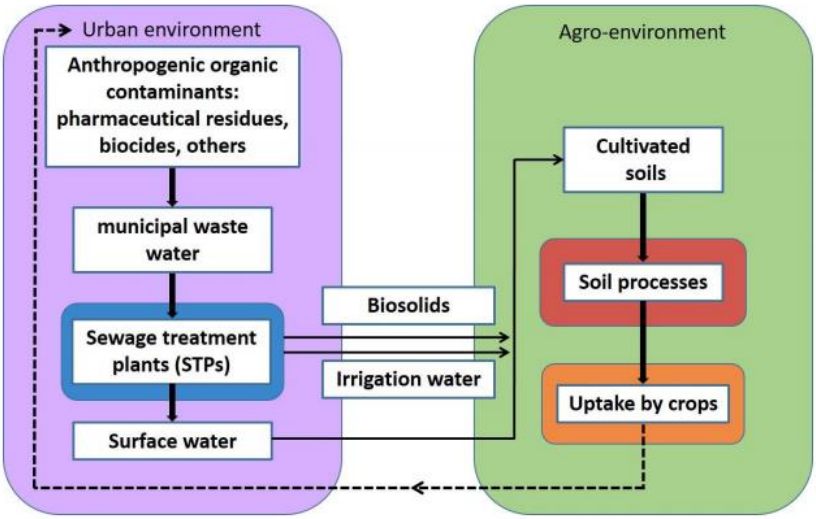

Figure 1: Scheme on sources and pathways for the occurrence of organic contaminants in the agro-environment and their distribution path

2. Materials and methods

In order to assess potential hazards of contaminated WWTP-effluent application to agricultural soils and to verify the positive effect of sludge composting with biochar addition, the fate of selected relevant contaminants, e.g. persistent mobile pharmaceutical active ingredients like carbamazepine, in soils and their uptake into agricultural products will be studied. Figure 2 describes the cooperation structure and the follow up of the working packages (WPs) with the responsible project partners.

For the project two different ^{14}C-radiolabelled reference substances will be selected. The selection will be based on their relevance as chemical contaminants in wastewater and sewage sludge (WP1). Different work

packages will use the ^{14}C-radiolabelled reference substances. The ^{14}C-radiolabel enables to follow the fate of the substances and their transformation products in the complex matrices during degradation (i.e. $^{14}CO_2$ or stable metabolite formation), plant uptake or entrapment in the matrix (formation of non-extractable residues or NER). Simultaneously, the sludge treatment techniques will be developed (WP2). From two waste streams (sewage sludge and biochar educt) a substrate will be produced, which will be used for fertilisation and soil improvement. Once the optimal composting setup is found, substrate will be produced for the further project steps. A greenhouse trial (WP4), outdoor lysimeter experiments (WP5) and a field study under realistic agricultural conditions (WP6) will be performed using the substrate added to local agricultural soils.

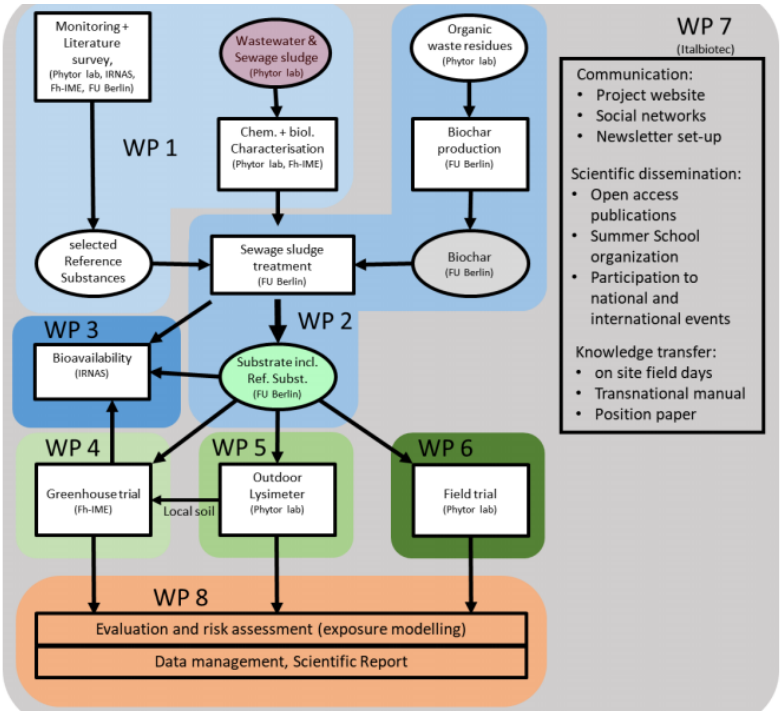

Figure 2: Scheme of project structure and visualization of workpackages (WPs). Note the different shapes used for strategic project materials in each WP (ovoidal: wastewater & sludge, waste residues, biochar, and reference substance) and project actions (rectangular).

After application of the substrate in the lysimeters and in the field, the farmer will still have to irrigate the field. The expected results from the project will be to demonstrate, that the contaminant applied with wastewater used for irrigation (represented by the ^{14}C reference substance) will be trapped in the substrate and the uptake / bioavailability in the substrate amended soil will be reduced significantly compared to a non substrate amended soil.

3. Results and discussion

As the project is at the very early stage now, we will not present many results here. The selection of sewage sludge, biochar source and reference substances is underway though.

4. Outlook

The combination of water scarcity and increasing demand for food in the Mediterranean area demands creative solutions such as treated wastewater irrigation. These solutions bring along exposure of the population to a plethora of chemicals for which we do not know the fate and which have the potential to produce environmental and health-related problems that require advanced and multidisciplinary research for their solutions. The established consortium for this PRIMA project aims to encourage multidisciplinary research activities that will enable to minimize the effects of agricultural practices and to avoid deleterious consequences on human health. The impact of this multi and trans-disciplinary project will involve further understanding of the fate of organic contaminants present in modern agricultural practices as well as identifying options for reducing risks.

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