Copper and zinc in sewage sludge – toxicity, sources and source reduction opportunities

Among metals regulated in connection to agricultural use of sewage sludge, copper and zinc often show up in quantitative chemical risk assessments and in life cycle assessments as particularly problematic. This does not necessarily mean that they automatically pose actual risks but rather that current models are highlighting them as potential hot spots. However, these metals are also among the ones that are restricted in legislation concerning the spreading of sludge in agriculture and they are known to negatively affect soil biota at certain concentrations.

Because these metals are highlighted in different ways, there is reason to map their routes into sewage sludge and explore potential opportunities for source reduction. Some sources are of course copper roofs, water piping and other materials in connection with water, storm water or wastewater but it is suspected that a relatively large share actually comes from the food industry and that they are added to for example animal fodder or to chicken meet before freezing. As the very purpose of regulating metals in sludge used in agriculture is to protect food production systems from high levels of these metals, it is ironic that they are likely to a large degree purposefully added in the food production system.

It is also of interest to review existing knowledge on the health and environmental impacts of zinc and copper that ends up on agricultural land by means of a literature review. This can provide an understanding for whether risk assessments and current policy instruments are exaggerating this issue or whether these metals truly are of great concern.

This master thesis project maps the potential sources of copper and zinc that end up in sewage sludge by means of substance flow analysis. Further, it compares these flows to current concentrations found in sewage sludge to check for completeness. It also checks the literature for information on the toxicity of these metals to different types of organisms. Finally, based on the types of sources, the sizes of flows and toxicity information, it identifies issues and source reduction opportunities.

The main focus in this project is on Swedish sewage sludge but there will be collaboration with another similar on-going research project in the Netherlands for exchange of information and experiences.

The master thesis can be done by one or two master students. It is an advantage if at least one of the students speak Swedish as some information may only be available in Swedish. The project is preferably performed in the spring semester of 2017. Students in the master programmes industrial ecology, innovative and sustainable chemical engineering or sustainable energy systems with an interest in societal flows of metals and toxicity are particularly suitable.

Examiner and main supervisor will be Professor Magdalena Svanström at Environmental Systems Analysis (magdalena.svanstrom@chalmers.se). Some supervision will also be provided by Assistant Professor Rickard Arvidsson and Postdoc Sara Heimersson. The student(s) will be placed at the Environmental Systems Analysis division.