

**STSM to Karolinska Institutet, Institute of Environmental Medicine, Occupational and  
Environmental Dermatology: Period: 2014-08-23 to 2014-08-29**

**FINAL REPORT**

**OBJECTIVES OF THE STSM**

- Learn the technique known as “acid wipe sampling” (AWS) and the “spot test” (ST) for the assessment of metals on the skin surface
- Understand which types of sensitizers, irritants, particles or toxic substances can be tested and which could be future applications of the techniques
- Hypothesize applications of these techniques in the framework of my current PhD, focused on skin absorption of metal nanoparticles

**ACTIVITIES UNDERTAKEN/PERFORMED DURING MY STAY**

• **Theoretical and practical aspects of nickel and cobalt spot test on materials and on skin:**

Nickel is a common skin sensitizer and EU Nickel Directive (1994) before, and the European chemicals regulation (REACH) after, posed the release limit of Ni from items to 0.5 µg/cm<sup>2</sup>/week. Dimethylglyoxime (DMG) is a colorimetric assay used as a screening test to detect nickel release from items when it exceeds this limit value.

Cobalt allergy is uncommon in general population but prevalent among patients with dermatitis and this metal can be a harmful sensitizer in occupational scenarios such as the ones of heavy metals industries and construction work. A spot test for the screening of cobalt has been set up too, and could be very helpful to check which items commonly used in the everyday life or as working tools can release this metal.

A demonstration on how to use spot tests has been carry out in the laboratory, where 1€, 2€ and 1SEK coins have been screened for metals release. Other spot tests have been performed in the urban surrounding, with the purpose to screening objects that can be handled or commonly touched in the everyday life, to illustrate that it is hard to avoid touching metals.

• **Theoretical and practical aspects of acid wipe sampling (AWS)**

This method enables to recover quantitatively the metals deposited on the skin and can be useful in workplace studies, in risk assessment and in follow-up after intervention. Briefly, a skin surface of about 2 cm<sup>2</sup> on the finger is wiped carefully for 30 seconds with wipes previously soaked with a known amount of wetting solution (0.5 ml of nitric acid 1%). The wipes from each area are pooled in the same container and nitric acid 1% was added to reach the final volume of 10 ml. Then the containers are shaken for 45 min. in order to extract the metals from the wipes.

This procedure has been performed on finger skin to investigate what happens after a short and repeated contact with coins. 1€ and 2€ coins have been handled by a volunteer for 15 min, which moved them back and forth between two boxes. To use the method in research studies, ethical vetting is needed.

- **Visit the clinic of skin allergy at the Centre for Occupational and Environmental Medicine, Stockholm County Council**

Discussion with clinicians about: theoretical aspects of performing patch test and the importance of applying a standardized dose of allergens on Finn chambers, the “open patch test” method, the in vitro assessment of formalin released from personal care products and objects.

- **Demonstration of tape stripping test and X-ray fluorescence analysis (XFR)**

The “tape stripping technique” is used for the assessment of skin exposure to organic and inorganic substances, which can be recognized in the stratum corneum. A demonstration on how to apply tapes on fingers has been performed (tape dimensions, pressure to apply, how to remove and to store the tapes) after handling of bulk material containing cobalt. Subsequently the analysis with XRF has been carried out. This latter is a non destructive analytical technique widely used as screening for chemical analysis. It works through the registration of characteristic fluorescent X rays emitted by the metal when high energy X-rays bombard it. It can be useful to quickly verify the chemical composition of the metals collected through the tapes stripped.

- **Dissolution experiments in artificial sweat**

Practical session on how to produce artificial sweat based on EN 1811 recommendations, considerations on the experimental model that is closest to reality. Release tests of Nickel, CuNi alloy and stainless steel 316L to investigate what can happen in case of short and repetitive contact.

#### **WHAT DID YOU GAIN FROM THE STSM FOR YOUR CURRENT JOB, CONCLUDING REMARKS**

During this stay I learned different techniques to detect hard metals both on items and on skin, which could be very useful if used singularly or in combination in occupational and environmental settings.

Some techniques are mostly useful when a quick screening is needed, such as Nickel and Cobalt spot tests. They can be used in allergic patients, i.e. when is desirable to know the metal release from an unknown item, and they can also be used to assess skin exposure and/or metal release from objects in workers when metal release is hypothesized. Other tests, such as acid wipe sampling (AWS) and X-ray fluorescence analysis (XFR) too, can instead provide a quantitative assessment of the metal amount.

Such analyses can also be extended to investigate the presence of other metals, and it would be interesting to investigate the effective presence on the skin of materials handled in their bulk form and in the form of nanoparticles, since it is well known that materials in nanosize range have a higher surface to volume ratio, and consequently if handled in equal quantities the amount possibly available for absorption is infinitely greater.

Another interesting point to be checked may be the execution of releasing test (eg nanosilver) from engineered tissues both in synthetic sweat either in solution containing nitric acid 1%, with the aim of investigating what is the percentage of the whole amount of metal which is released in physiological conditions.

As last but not least point gained during this experience has been observe the Swedish way to set up and manage a laboratory and run experiments, which I do really appreciated!

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