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Case Study - Chronic Classification of a Nickel Matte Based on Transformation / Dissolution Characteristics

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Problem Statement: Metals and metals compounds are classified under the EU CLP at the chronic level based on the loading cutpoints of 1, 0.1 and 0.01 mg/L. The lower two loadings are unattainable under normal laboratory conditions (for comparison, a single eyelash can weigh approximately 0.075 mg and the 0.01 mg/L loading is equivalent to 1 mg of the substance in a 100 L barrel).

Scientific Issues: Aquatic hazard classification proposals are mandatory for producers, importers, and users of chemical substances to secure and expand on their markets within the European Union (EU). The EU has modified the UN GHS to arrive at their Classification, Labeling and Packaging (CLP) regulation. The EU CLP framework retains the Acute 1 and the Chronic 1 levels of the basic UN GHS scheme, but omits the Acute 2 and 3, while retaining the Chronic 2, 3 and 4 levels. As in the basic GHS scheme, under the EU CLP, the acute and chronic categories are applied independently. The basic UN GHS appears to be structured for the hazard classification of highly toxic, synthetic organic chemicals and has chronic concentration cutpoints of as low as 0.01 mg/L. For metals and metal compounds, if chronic ERV data are available, the cutpoints in the EU CLP are the same as in the basic UN GHs strategy, with the provision that metal substance loadings of 1, 0.1 and 0.01 mg/L that deliver metal concentrations exceeding the selected chronic ERV will classify the substance for chronic levels 3, 2 and 1 respectively. This applies in the case of evidence of rapid environmental transformation, such as speciation change to a less harmful

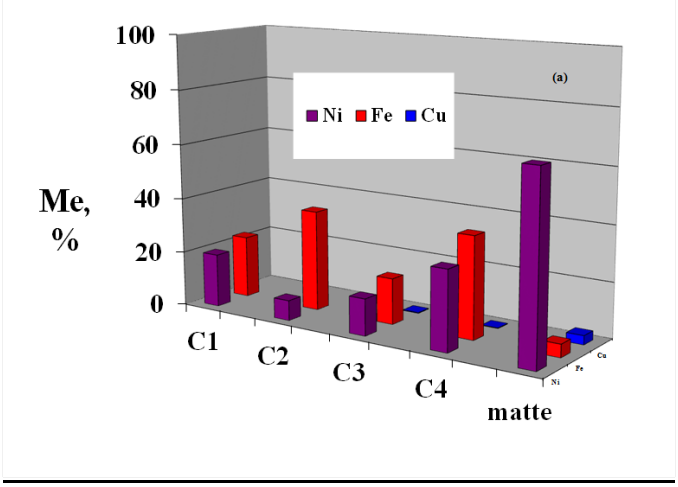
form or precipitation over 28 days. If there is no evidence of rapid environmental transformation, then the scheme calls for chronic classifications 2 and 1 if loadings of 1 and 0.1 mg/L, respectively, exceed the selected chronic ERV. Because of practical difficulties in obtaining such low mass loadings, extrapolation of Transformation/Dissolution (T/D) data to lower loadings in a precautionary way is proposed in the EU CLP guidance document (EU 2013).

Current risk assessment: Loading cutpoints of 0.1 and 0.01 mg/L are not attainable under normal laboratory conditions and so a method of extrapolation and scaling of T/D data was developed (Skeaff and Beaudoin, 2014) in order to meet the chronic hazard classification requirements as set out in the EU CLP.

Example: Using T/D kinetic data from Ni matte (M143) (data from Skeaff and Beaudoin, 2014)

I- Derivation of UN GHS hazard classification outcomes
II- Derivation of EU CLP hazard classification outcomes

I- Derivation of UN GHS hazard classification outcomes

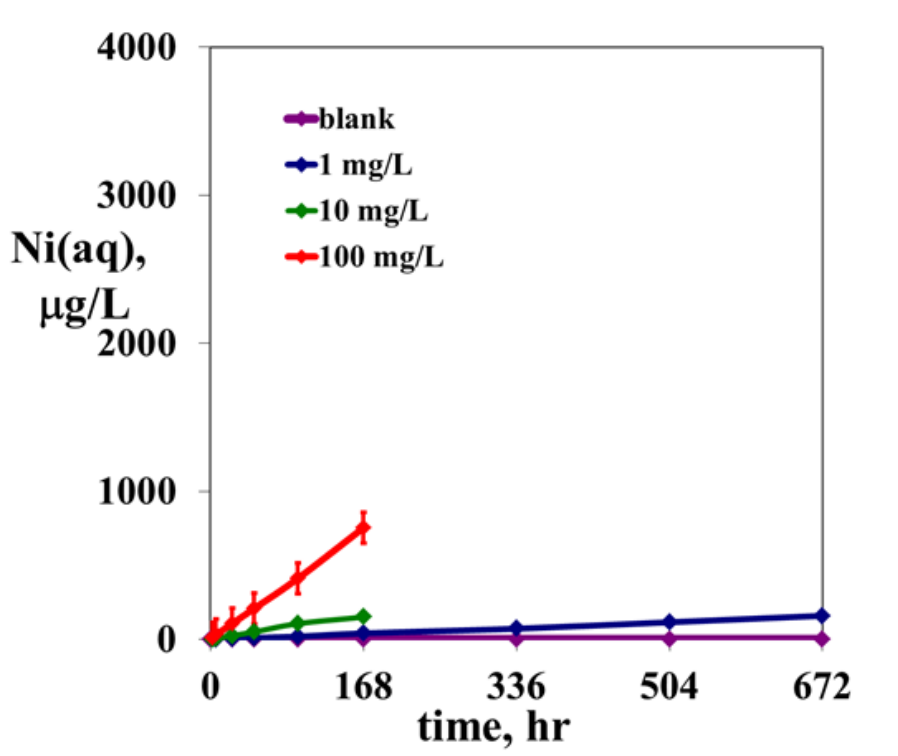


Step 1

- Test the Ni matte at the 100, 10 and 1 mg/L loading in triplicate with procedural blanks following the procedure set out in the T/D Protocol.

Step 2

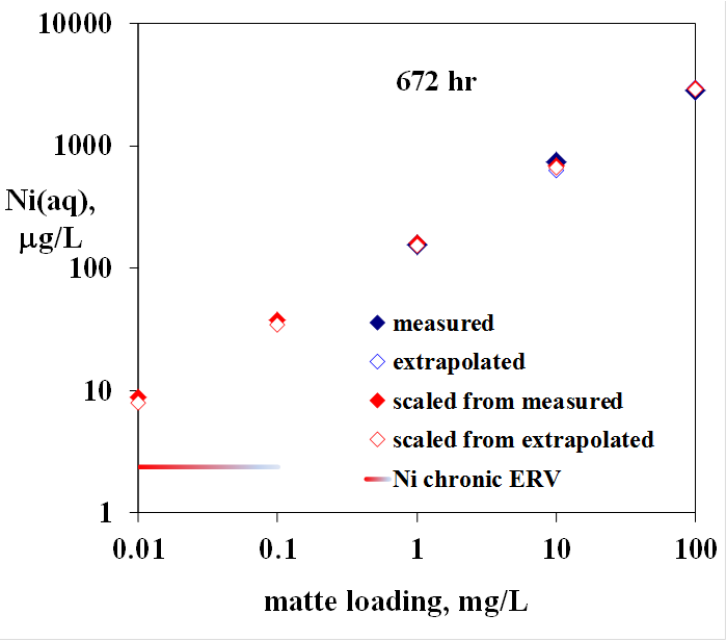
- Derive the net average T/D reaction kinetic data, expressed as Me(aq) and plot as a function of time. For multi-component systems, using the accepted ERV, calculate the acute and chronic TU. For the 1 mg/L loading, the 168 h concentration of the acute TU was 0.35, so the Ni matte would not classify as Acute 1 under the GHS. For the 10 mg/loading, the 168 h TU was 1.3 so the Ni matte would classify as GHS Acute 2-CHronic 2.



II- Derivation of EU CLP hazard classification outcomes

Step 1

- Using the T/D kinetic data for the 10 and 100 mg/L loadings from 0 to 168 h do a regression analysis and then extrapolate the data to 672 h to yield a Ni(aq) value at t = 672 h. Also do a regression analysis of the 1 mg/L loading 0 to 672 h dataset to derive a Ni(aq) value at t = 672.
- Applying a regression analysis to the 672 h Ni(aq) values for the 100, 10 and 1 mg/L loadings, derive a log-log linear plot and then evaluate Ni(aq) at 0.1 and 0.01 mg/L.
- As the concentration for the 0.01 mg/L loading for 672 h was greater than the chronic ERV of 2.4 µg/L for dissolved Ni, the Ni matte would classify as Chronic 1 under the EU CLP.



Discussion questions:

1. Can the use of extrapolated and scaled data be justified for chronic hazard classification of metals and metal compounds?
2. Are there any examples where this approach may not be valid?
3. Should this approach be validated and how?
4. How would you conduct a sensitivity analysis with respect to the chronic classification outcomes taking into account the possible errors in extrapolation and scaling?