

Research Round Up

Title of the projects:

1. Capacity of New Zealand Dairy soils to retain estrogenic/androgenic steroid hormones
2. Fate and behaviour of steroid conjugates (3-sulphates) in NZ soils?
3. Modelling the simultaneous parent compound degradation and metabolite formation fraction of veterinary antibiotics during degradation in soil microcosms
4. Fate of estrogenic steroid hormones associated with land-application of dairy effluent using large lysimeter

Project Leader: Dr. Ajit K Sarmah

Organisation: Landcare Research New Zealand, Hamilton

Contact Details:

Phone: 64 7 8593737 **Fax:** 64 7 8593701 **E-Mail:** sarmahA@LandcareResearch.co.nz

Funding Body: Foundation for Research Science and Technology, NZ; USEPA, Cincinnati; Lincoln Ventures, Lincoln, NZ

Collaborating organisations:

1. HortResearch, Hamilton
2. Lincoln University, Copenhagen University, NSW DPI,
3. Purdue University,
4. Lincoln University, Lincoln Venture Ltd.

Key issue/s addressed:

To determine if steroid hormones associated with dairy effluent represent a risk to the New Zealand environment; Do steroid conjugates behave similarly in relation to their sorption and degradation in soils as compared to their free counterpart (estradiol and estrone)? To determine the regulatory end-points for selected veterinary antibiotics using data obtained under controlled laboratory conditions.

Objectives:

1. Determine sorption of steroid hormones in selected NZ soils; and assess the role soil organic matter.
2. Determine sorption of 3-sulphate conjugates in soils with CaCl₂ and artificial urine as mediator solution; provide a comparative assessment on their sorption behaviour in selected NZ soils; Determine degradation of free and conjugated steroids in soils and assess the biological activity as function of degradation rate using CALUX technique; derive appropriate DT₅₀ and DT₉₀ values for the parent and metabolites using non-linear mathematical models
3. Derive regulatory end-points (DT₅₀ and DT₉₀) for selected veterinary antibiotics used in CAFO practice.
4. Determine the leaching potential of steroid hormones using large soil lysimeters after effluent application.

Planned Outputs/Outcome (by when):

1. Publishing results of sorption studies (in the process)
2. Results will be published through the completion of PhD project in Jan 2009
3. Derivation of degradation end-points for veterinary antibiotics in soils (Currently on-going)
4. Results will be published through the completion of PhD project In May 2009

Methodological approach:

1. Laboratory batch studies using solvent extraction technique to measure sorption coefficients in whole soils and with humic extracted fractions
2. Soil microcosm studies are performed under controlled laboratory conditions to measure degradation rate for hormones and their conjugates under varied temperature moisture regimes
3. Solid-phase extraction and solvent extraction, followed by blow down using rotavapor and N₂ are carried out in the laboratory and analysis by HPLC-UV method and CALUX assay to check for estrogenicity.

Key findings so far:

1. NZ soils have a medium to high potential to retain single free estrogenic hormones
2. Steroid conjugates are poorly sorbed and on average have few orders of magnitude lower log K_{oc} values than their free counterparts, this indicating high mobility.

Please tick the relevant theme below:

Monitoring/ Analysis

Exposure assessment

Environmental Fate

Effects