Chemodynamic study of chlorinated pesticide in acidic and alkaline soils

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Despite being banned atrazine is the most widely used herbicide and is registered in more than seventy countries worldwide. In Pakistan atrazine has been used extensively for broadleaf weed control in corn and sugarcane production as well as in several minor crops. Parveen and Masud (1988) detected some chlorinated insecticide in cattle drinking water from Karachi (Pakistan), while Jabbar et al. (1993) reported monocrotophos, cyhalothrin and endrin in shallow ground water of Faisalabad (Pakistan), the cotton growing area of the country. Atrazine is retained against leaching losses in soils principally by sorption to organic matter, but the mechanism of sorption is not clearly understood. Quantification of soil is needed for predicting the fate of agricultural chemicals in soils as soil characteristics exert dominating influence on chemical-eosorbent interactions. The present study is an attempt to determine the influence of physico-chemical properties of soil on the adsorption of atrazine in three different soils (Agriculturtal, Garden and Barren) with variable organic matter. Such studies have the potential to contribute significantly to a better understanding of post-application herbicide dynamics in agricultural fields. Composite sample of each soil type was analyzed for bulk density, moisture content, color, pH, electrical conductivity, organic matter and pphosphorus content by standardized methods. Batch experiment for pesticide residue analysis was conducted with variable atrazine initial concentration (10ppb, 30ppb, 50ppb), variable pH (4, 7 and 10) and variable contact time till saturation. The distribution of bound atrazine was determined by Ethyl Aetate extraction method. Atrazine remaining in each soil sample after extraction was determined by UV-Visible spectrophotometer at 223nm. Agricultural soil samples showed optimum adsorption, it may be related to high organic content. Sorption and binding of atrazine to SOM can occur as a result of hydrophobic bonding. pH 4 is found optimum for all soil types and showed maximum atrazine adsorption. The present study also showed that till saturation at 120 hr contact time adsorption increases with increasing contact time. Kinetic studies include calculation of Kd and Koc. The results showed that atrazine adsorption followed psedo first order reaction.

The role of geochemists in the era of "Peak Everything"

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Peak oil will occur in the next five years upon which extraction will no longer meet oil demand and the amount of petroleum available to society will begin to dwindle. At the same time oil prices will continue to increase, affecting the world GDP. Regional gas production rates have declined in for example the North Sea. Coal production will begin to peak and decline in ~15 years. Heinberg [1] has concluded that because fossil fuels supply ~85% of the world's total energy, peaks in these fuels will result in the word's energy supply shrinking within a few years.

We are also facing ecological dilemmas related to population pressure, habitat destruction and resource depletion. Phosphate will run out by 2020. Other resources that will decline in the next decades are wild fish, *per capita* freshwater availability, arable land in agriculture production (due to soil degradation), grain production, and yearly extraction of some metals that are crucial for our present day industry. These include uranium, copper, platinum, silver, gold and zinc.

Humanity is thus at the end of a historical era of material abundance and cheap energy. We have reached the inception of over-consumption and resource availability. Europeans are living as if we had three Earths – and Americans as if we had five Earths to support us! A major re-think is imperative. For example, agriculture needs to move from being energy intensive (fertiliser production) and pesticide based (made from oil).

Sustainability is a core concept for geochemists to engage with and unite forces with society to develop new technologies, based on more common metals and minerals than our present day "stuff" is made out of. Our involvement can lead to solutions that transform industrial products from being made from scarce minerals to abundant minerals, moving towards nature-inspired design principles that can make industry sustainable [2]. The 21st century will pose many resource and energy difficulties to the world population – and geochemists are ideally suited to play an active role in finding solutions to these challenges.

[1] Heinberg R. (2007) *Peak Everything. Waking up to a Century of Declines.* New Society Publishers. [2] McKenna W. & Braungart M. (2002) *From Cradle to Cradle. Remaking the Way We Make Things.* North Point Press.