SALTS, SOILS AND SOLUTIONS

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The treatment of domestic effluent in a variety of on-site systems places much emphasis on a simplistic view of domestic wastewater. Typical water use within the house is the time-honoured tradition of bathing as practised since days of the Romans – warm running water, soaps and perfumes, and the discharge to the environment of the "used" water. In recent years, and increasingly since the late 1940's, non-urban dwellers have adopted other "technological" advances such as flush toilets, water-hungry washing machines and high pressure water pumps. While all these devices give rise to understanding and controlling the "hydraulic" design criteria, there is almost a "black hole" about the chemical additives to the wastewater.

A quick stroll through a large supermarket and all its 30,000 items should be a sharp enough reminder that most of the products on the shelves will eventually pass into the wastewater system. Whether it is the phosphorus in Coca-Cola™ (food acid 338), the cyanide in the almonds, the 1269 mg/100 g potassium in Smith's ™ Potato Crisps, 6290mg/100 g sodium in Kraft ™Peanut butter, or the nitrites used in meat colouring, the food we eat will eventually end in the on-site treatment system. Add to this cocktail of chemicals the range of laundry detergents rich in phosphorus (up to 7.8g/wash using Cold Power ™) , sodium (140 g/wash using Savings™), sulphur (mostly as filler), the numerous chemicals in some of the personal hygiene items such as zinc in anti-dandruff products and then the very high pH of drain cleaners and surface cleaning products used around the house. Is it any wonder the quality of wastewater is so highly variable from house to house?

Not only is the quality variable between houses but within house variability from day to day and time of day shows the effects of these chemicals on pH and salinity (as measured by electrical conductivity). That we are only interested in the hydraulic load, and the nitrogen and phosphorus loads when we make our assessment of land area requirements for sustainable discharge makes a mockery of sustainable reuse. Of equal importance is the suite of other chemicals that are needed to balance the plants' ability to assimilate nitrogen and phosphorus. Potassium, sulphur, calcium, magnesium and iron are all macro-nutrients that are essential to the well-being of plants. While we may be providing unlimited water to the plants, water alone will not promote healthy vegetation and the more water we use to irrigate the more plant nutrients we must balance in the soil.

What of biodegradability? By definition, only organic products can be degraded biologically and there is no standard for biodegradability. While some manufacturers would lead us to think that their products are biodegradable, the standard often quoted by laundry detergent manufacturers is really a laboratory method for determining bio-degradability rather than a measure of performance. Similarly, the labels "safe in septic tanks" are mostly made without any research to support the statement. What do we mean "safe in septic tanks"?

Whether the treatment device is a simple septic tank (primary treatment), an aerated wastewater treatment system (secondary) or additional effluent polishing in sand filters, peat biofilters, wetlands or microfiltration, most of the chemicals pass through the system unaffected. Certainly proteins may be degraded to basic nitrates and sulphates, and potassium from bananas will end up as potassium ions, the elements remain for assimilation in the receiving environment, either for plant assimilation, immobilisation or contamination.

So why the thrust on chemicals in domestic wastewater? Quite simply the array of chemical entering the wastewater stream, while maybe not affecting the primary treatment, may have a significant impact upon the soil. In almost all cases, the soil is the receiving environment and this paper is directed to only application (disposal, reuse) in soils. Since soil properties are themselves highly variable there is no "generic" check list that can be used to identify the problems or benefits of applying domestic effluent to the soil. Each assessment must consider the particular soil properties and the effluent quality. The concern that "salinity", as a result of on-site effluent reuse, may seriously degrade the soil, even over short periods, is often overlooked. In the long term loss of vegetative cover may inhibit the return of the water to the hydrologic cycle. Of more serious impact upon the soil is sodium, well documented for its ability to reduce soil hydraulic conductivity as well as negatively impact on plant functions. Changes to soil pH are likely implications of high salinity and/or high sodicity from the effluent and should be considered when assessing a site for on-site effluent application.

During presentation of this paper, examples of source inputs to the wastewater will be matched with the likely effects on soil and vegetation. Source reduction is the most effective means of limiting detrimental chemicals in the wastewater, however, amelioration techniques can be used when wastewater chemistry and soil physical attributes are not as compatible as would be preferred. The effects of salts on soils must be seen as a solution to on-site effluent reuse and accounted for in the design as well as the operational phase.

Note:

Only the extended abstract (above) was prepared for publication in the proceedings.