<table>
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<tr>
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<tbody>
<tr>
<td>Title</td>
<td>Butane stripping of organic contaminants from water and/or wastewater</td>
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SUMMARY

In this study, n-butane was used as extractant to remove various organic pollutants including halogenated hydrocarbons and phenols as well as aromatic compounds from aqueous matrices. High removal efficiencies can be readily achieved for a great number of representative model organic pollutants. Under favorable conditions, the removal efficiencies for most of the hydrophobic pollutants were greater than 90% in a single extraction stage. It is evident that the presence of certain cosolvents in the extractant has a pronounced effect on the overall extraction performance. The removal of phenol and certain substituted phenols are significantly enhanced with the use of a cosolvent, such as n-butyl acetate (25%v) leading to an improvement in the removal efficiencies ranging from 54% to 94%.

Commercial liquid petroleum gas (LPG) was engaged in this study, tentative results showed that it is economical and a practical substitute for pure n-butane. The work also presents the preliminary results in the removal of pollutants from recycled butane and discussion on the removal of residual butane in the treated water.

The distribution constant, $K_D$, is one of the key parameters in determining the extraction efficiency. Experimental results illustrated that there is a fundamental linear relationship between the distribution constant ($K_D$) and the aqueous solubility of the solute ($S$). The model stated that log $K_D$ decreases linearly with log $S$ via the equation, log $K_D = A + B \times \log S$. This correlation equation derived from this work can be explained in terms of solution thermodynamics. The relationship can be
broadly applied to many different classes of chemical compounds as well as to many
different solvent extraction systems. The linear equation as obtained by the regression
method allows one to estimate the distribution constant and predict the result of
butane stripping if the aqueous solubility of certain solute is available.

The tentative approach of the kinetics of butane stripping demonstrates that
the concentration of solute in aqueous phase has an exponential decay dependence
with the extraction time. The initial extraction rate also found to be a function of the
external agitation speed, initial concentration of solute and operating temperature.

Several accurate and convenient analytical methods were developed and
established for this work in order to facilitate the quality control on the collection of
analytical data for the butane stripping experiments. GC, HPLC and TOC analyzer
were used to determine the analytes concentration related to butane stripping. Purge-
and-Trap (P&T) method was also employed as a pre-concentration step prior to the
gas chromatographic analysis. The detection limits of these methods for many
analytes are at 1.0 µg/L (ppb) level or better, and the relative standard deviations are
often less than 10%.

Keywords: butane stripping, liquid petroleum gas, organic pollutants, extraction
efficiency, distribution and partition constants, removal efficiency, aqueous solubility,
model, estimation, purge-and-trap (P&T), gas chromatography (GC), high
performance liquid chromatography (HPLC) and total organic carbon (TOC).