MAXIMISING THE EFFICIENCY OF SOLVENT RECOVERY PLANT WITH INFRARED ANALYSIS
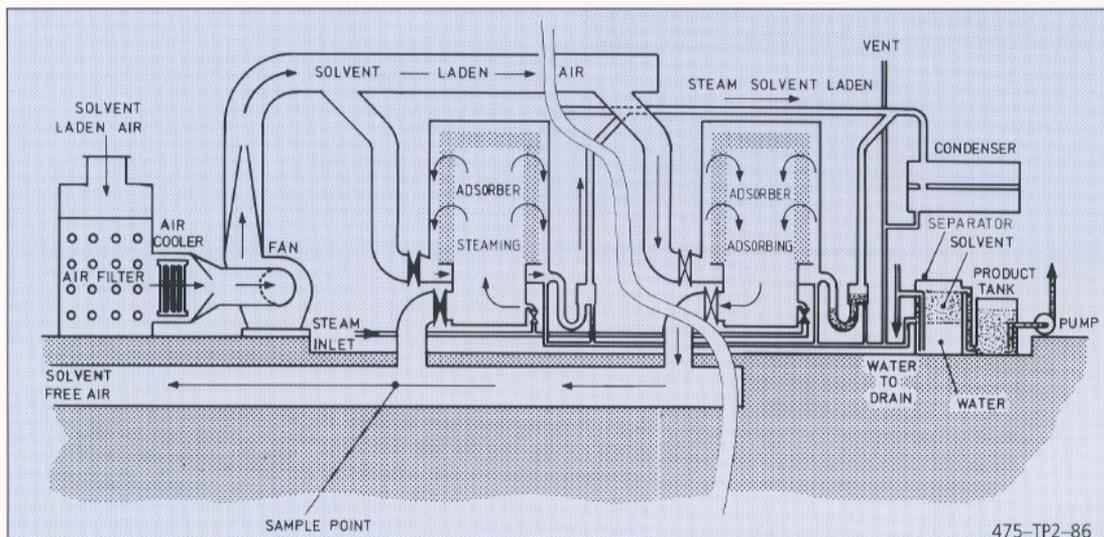

Figure 1: Solvent Recovery Plant

Most companies using any appreciable quantity of solvents will be keenly aware of the large price increases there have been for many solvents in recent years.

With the advent of improved designs, analysis is becoming more important in maximising a solvent recovery plant's efficiency and minimising its energy consumption.

Infrared Gas Analyser Control

When solvent laden air is passed through an absorber containing a bed of activated carbon, only a few parts per million of solvent will normally 'slip' through the bed. But, as the carbon nears its saturation point, the concentration of solvent slipping through the bed will rise rapidly and when a predetermined level of slip is reached, the absorber involved must be changed from 'adsorb' mode to 'desorb' mode (i.e. steamed out to desorb solvent from the carbon). For processes where both the airflow and solvent concentration remain constant, it is quite adequate to control the adsorb/desorb cycle change over for each absorber by timer control. In practice, most processes have both variable solvent concentrations and variable air flow. In such cases, whilst timer control has in the past often been supplied for reasons of economy, the rising cost of solvents and energy, particularly steam, make gas analyser control virtually mandatory for recovery plants of any size. Various analysers have been employed but that favoured is a single beam, dual wavelength infrared analyser having high sensitivity and particularly suited to measuring concentrations in the range O-250ppm or better, with an accuracy of 1% FSD.

The analyser operates by monitoring the exhaust air leaving the absorber which is next in line to be steamed (i.e. nearing the end of its adsorption cycle). It works by monitoring the rise of solvent 'slip' through the carbon bed. When this reaches a pre-set value, a signal is generated which automatically opens and closes the valves on the plant so as to take the particular absorber out of its 'adsorb' mode and put it on to 'desorb' mode.

Solvents

Users of solvents may utilise a single component or a multi-component mix. The latter makes the analysis more complex in respect of which solvent needs to be identified for 'slip'. If there are common absorption bands a 'total analysis' is possible, but it will be proportional to the concentration and absorbance of infrared for each component. If a single component is required, regardless of mix, a peak has to be identified to avoid any interfering components.

Frequently the measurement in a multi-component mix will be carried out to identify the higher cost solvent.

Typical solvents that can be measured using Infrared analysers are:

Acetone	n-Butyl Acetate
1-Butanol	Carbon Tetrachloride
Chloroform	Ethyl Acetate
Ethanol	Diethyl Ether
Hexane	Methyl Alcohol
Methyl Ethyl Ketone	4 Methyl-2-Pentanone
Methylene Chloride	Tetrachloroethane
Tetrahydrofuran	Toluene
n-Propyl Acetate	1-Propanol
1.1.1 Trichloroethane	

With a good analyser, it is possible to control the termination of the absorption cycle to within a few seconds of the optimum cycle time, the latter being an adjustable period for varying concentrations of solvent being presented to the solvent recovery plant. In this way, the maximum use is made of the carbon bed by ensuring that there is always the maximum load of solvent on the carbon to be desorbed by the steam. This, in turn ensures that optimum sensible/non-sensible steam consumption ratios are achieved with consequent energy savings.