PART 3 – AROMA CHEMICALS from PETROCHEMICAL FEEDSTOCKS

9 ENVIRONMENTAL ISSUES

9.1 Parahydroxybenzaldehyde/p-Anisaldehyde

A research Safety, Health and Environment Impact Assessment Study was carried out in May 1999.[38] The study was an assessment of the Safety, Health and Environment hazards and impact of the proposed manufacturing process, specifically related to chemical hazards, disposal of wastes, site and community considerations, which may arise from the manufacture or use or final disposal of the product. The report was conducted with the AECI Richard's Bay site identified for commercialisation of the process.

The process gives rise to a number of solid, liquid and gaseous waste arisings. The problem areas would be:

- Solvent recovery – the solution would be to recover as much solvent a economically possible.
- The Chemical Oxygen Demand/Saline aqueous effluent must be treated to meet the requirements of the municipality for marine disposal (if the plant is located at the coast). The treatment of this effluent would obviously have to be considered if an inland site is chosen.
- The distillation residues, in the form of tars, are suitable to feed to an incinerator. The capital should therefore take this into account. The possibility of disposing to a fuel oil recycler or burning in an existing local fired heater also exists.

The oxidation reaction is carried out in a loop reactor, where the vapour phase does not form a continuous phase, and the oxygen concentration is kept outside of the explosive region by adding nitrogen if necessary. The chemical oxidation reactivity hazard in the process has therefore been removed.

The process has an environmental load factor of 4 (including m-cresol and excluding water), which is reasonable compared with other chemical processes. This number is a measure of how "wasteful" the process is and measures mass of material in/mass of material out. The project is not a large user of water and energy. The spent catalysts will be returned to the supplier. No objectionable odours were identified which would give rise to neighbourhood complaints.

The methylation of pHB can use either dimethyl sulphate or methyl chloride. The choice as to which methylation agent to use will depend on whether the plant is located at the coast or inland. In South Africa, dimethyl sulphate is preferred for inland locations, as the by-product, is sodium sulphate. Methyl chloride would be preferred at coastal regions as the by-product, sodium chloride, can be disposed of to sea.

[38] ISHECON Report: May 1999

No potential Safety, Health and Environment show-stoppers" were identified. There were not considered to be any obvious environmental and socio-economic impacts.

9.2 Menthol

A research Safety, Health and Environment Impact Assessment Study was carried out in 2000.[39] The study was an assessment of the Safety, Health and Environment hazards and impact of the proposed manufacturing process, specifically related to chemical hazards, disposal of wastes, site and community considerations, which may arise from the manufacture or use or final disposal of the product. The report was conducted with the AECI Richard's Bay site identified for commercialisation of the process.

The report stated that the process is inherently clean and uses few resources. There is no large water requirement and there is a relatively small amount of waste, which can easily be disposed of. The process gives rise to two effluent streams.

- Tars from the thymol distillation bottoms, which can be disposed of by companies that recycle similar wastes into fuel oil blends.
- Sodium acetate is a 50% aqueous stream, which should be amenable to marine disposal if the plant is situated at the coast. The Richard's Bay Borough has two pipelines with a capacity of 200,00 m^3/day. The main limitation would be any toxic effect on marine life, and CSIR Environmentek have a test (the sea-urchin sperm test) to determine the safe dilution factor required.

The process had an environmental load factor of 3.2, considered reasonable compared with other chemical processes. The odour from the plant was not believed to give rise to any neighbourhood complaints, although cresols do have a strong odour. Disposal of spent catalysts was not viewed to be a major problem as the amount generated is extremely small and the catalysts have a long lifetime.

The report concluded that there did not appear to be any Safety, Health and Environment issues that could be viewed as potential "show-stoppers". There were not considered to be any obvious environmental and socio-economic impacts.

9.3 Vanillin/Ethyl Vanillin

A full Safety Health and Environment impact assessment was not carried out by the CSIR as this technology package was completed after AECI's exit from its Aroma chemical business and its technologies transferred to the CSIR. The Safety, Health and Environment

[39] ISHECON Report: February 2000

assessments performed are generally site specific, and as the CSIR does not develop technology with any particular site identified, the assessment could not be performed.

Study of the process chemistry by the Consultant for the production of vanillin and ethyl vanillin identified one potential area of concern. The process for production of both vanillin and ethyl vanillin involves a bromination step, using bromine as a reagent. Hydrogen bromide is produced and is vented from the reactor. The hydrogen bromide is scrubbed with caustic and bromine is regenerated for recycle using chlorine gas. The bromine regeneration step produces a sodium chloride effluent. The bromine associated with bromo-pHB is displaced later in the process, generating sodium bromide as a by-product in a methanol solvent.

In the new vanillin/ethyl vanillin process proposed by the CSIR, water is injected after the displacement reaction and the methanol solvent recovered. The aqueous stream consisting of sodium vanillin and sodium bromide is acidified with dilute sulphuric acid and vanillin separates out as an organic phase. The sodium bromide together with the sodium sulphate resulting from the displacement reaction remains in the aqueous phase. The CSIR has not declared how this sodium sulphate /sodium bromide aqueous stream is to be handled. In the absence of a proposed recovery scheme for the salts, the aqueous stream will have to be regarded as an effluent stream.