

PART 3 – AROMA CHEMICALS from PETROCHEMICAL FEEDSTOCKS

16 RECOMMENDATIONS

16.1 Value Stream Recommendation

Strategic Intervention: To motivate the establishment of an Aroma and Fine Chemicals platform based on a mixed cresols feedstock, deploying the CSIR and Mbuyu Biotech suite of technologies to produce the portfolio of products identified in this FRIDGE study, comprising the pHB-intermediate, technical and flavour grade pAA, menthol and OMC as the first phase.

Specific strategic recommendations

1. Develop a strategy to elicit interest from prospective investment parties that have the capacity of completing a detailed business feasibility study into launching the Aroma and Fine Chemical platform and developing a detailed implementation strategy. The investment partner must therefore have the capacity of ensuring that the following are achieved:
 - Identify and secure a source of mixed cresol feedstock at a price equivalent to a pure cresol price of no more than \$ 1,250 – 1,458/ton.
 - Secure the key enabling technologies for the portfolio of products and ensure that all process development is completed and ready for implementation.
 - Secure an internationally competitive technology in respect of OMC.
 - Define the detailed utility and service requirements for the envisaged complex.
 - Identify and select a potential site capable of providing the utility and services requirements at competitive input costs. The site should have the potential for expansion.
 - Develop a strategic plan to attract international strategic alliance partners for menthol and OMC by leveraging the fact that the global competitiveness of the technologies and the potential business can be demonstrated.
2. Facilitate the provision of a world-class site; a secure competitive feedstock; well-trained professional staff, thereby increasing the prospect that an international strategic alliance partner/s can be secured by the prospective investment partner.

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Strategic Intervention: To motivate the incubation of the smaller volume aroma chemicals as a second phase investment by SMEs by South African downstream processing incubators.

Specific strategic recommendations

1. Develop a strategy for the smaller volume high value aroma chemicals not included in the Aroma and Fine Chemicals platform project as the second phase of investment in expanding the value chain. Use could be made of the relevant sectoral incubators.

16.2 Cross-cutting Recommendations

16.2.1 Skills Development

The limited availability of skills has been cited as a constraint to growth in the chemical industry.

Strategic Intervention: To target training interventions by assessing the skills development requirements of existing Aroma Chemical, Essential Oil and Plant Extracts, and Flavour and Fragrance industries.

Specific strategic recommendations

1. Develop learnership programmes with the qualification of specific skills in technical formulation and olfactory related subjects. Olfactory related subjects should also be taught by the higher education institutions at post-graduate level.
2. Encourage learnerships within a 'new' qualification of technical sales, in support of the fine and speciality chemicals sub-sector.
3. Develop a strategic plan whereby existing research organisations and fine chemicals companies could play a pivotal role in the training of technical skills. Technologist exchange programs with the new aroma and fine chemical business could be implemented to train and hone operational skills (by the trainee working on pilot or existing manufacturing plants) and scientific skills (through supplementing technical resource requirements on development projects).
4. Develop training programmes at higher education institutions aimed at furnishing post-graduates with skills targeted at the downstream chemical manufacturing industry. Courses should include aspects of fundamental chemical training, such as industrial chemical synthesis, batch processing, small plant operation, and

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product formulation. Post-graduate skills with respect to the successful transfer of laboratory procedures into commercially viable production processes should also be taught. These programmes should furthermore include a strong entrepreneurial and business development component, including modules in accounting, business economics, marketing, strategy, management of operations, quality and project management. This will promote the training of numerate graduates with the unique combination of technical as well as management skills.

5. Promote industry-led programmes and networks leading to collaborative efforts between academia and industry. An example is the United Kingdom's BRITEST™ programme. This programme's specific objective is for private companies to participate and provide leadership for projects designed to enhance the industrial relevance of university research and make it more broadly available to industry. The programme focuses on early stages of chemical processes where chemists' ideas are converted into process applications at industrial scale. The outcome of the programme is the innovative development of better approaches for scaling up from test-tube to production plant in the downstream manufacturing industries, thereby improving economic competitiveness. The programme promotes access to creative development in science, engineering and technology, as well as ensuring a continued supply of well-trained scientists and engineers. This interaction will furthermore serve to increase awareness about the skills required and used in the chemical industry.

16.2.2 Development of a Pipeline of Aroma and Fine Chemicals

Aroma and fine chemicals companies are dependant on their ability to create innovative products in order to grow sales, create markets and add value to existing products.

Strategic Intervention: To develop a balanced portfolio of a future pipeline of products.

Specific strategic recommendations

1. Hold discussions with South African Flavour and Fragrance houses (both local and international) to explore the potential for integration of the nascent aroma and fine chemical industry into their activities. These discussions should identify further opportunities for the manufacture of a pipeline of Aroma Chemicals specifically selected as being relevant for the regional market.
2. Identify technology partner/s for the research and development of a future pipeline of Aroma and Fine Chemicals to this value chain. The partner/s should be

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research organizations/institutions with specific experience in the field of Aroma and Fine Chemical research and innovation.

3. Consider the use of existing pilot plant and small-scale toll manufacture infrastructure to reduce the risk of full-scale dedicated investments by allowing technology testing, scale-up and early market penetration for the Aroma and Fine Chemical business. Such infrastructure will have to comply with current Good Manufacturing Practice. The manufacture of small pilot scale quantities would allow early assessment of the product's ability to meet market needs, and will promote direct customer interaction at an early stage. Furthermore, new products or changes to existing product specifications could rapidly be implemented and tested within the customer's flavour and fragrance formulation or product. The Aroma and Fine Chemical business can therefore meet the requirement of customer responsiveness before a full-scale investment in new capacity is required.
4. Develop a strategic plan to incubate the smaller volume aroma chemicals identified and proposed as a second phase investment by the South African Downstream Processing incubators. This process will increase the success rate of the start-up companies and provide some of the skills needs, both business and technical, identified as being critically required by the South African chemical industry.

16.2.3 Support of the innovation cycle

An innovation chasm in the phase between research and development and the commercialisation of viable products has been identified. Overcoming these constraints is critical to ensuring the longer-term sustainability of this industry.

Strategic Intervention: To bridge the innovation chasm between research and development and the commercialisation of viable products.

Specific strategic recommendations

- 1 Review the funding process for the latter phase of technology innovation i.e. scale-up, product introduction, process engineering, and new plant trials, before projects meet the criteria for private sector investment. This could have a direct impact on stimulating industry demand for research.
- 2 Involve potential funding sources in the formulation of policy and strategy for the development of the industry. These agencies need to be informed of the

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dynamics of the industry so that they can properly develop funding packages to meet the needs of the industry. Furthermore, the industry needs to determine what factors need to be in place in order to make the industry more attractive to these institutions.

16.2.4 Integration into the downstream Flavour and Fragrance Industry

Consideration should be given to the development of complementary value chains in the fields of flavour and fragrance formulation, cosmetics and nutraceuticals. These draw heavily on the same skills and experience base.

Strategic Intervention: To begin the process of integrating the Aroma and Fine Chemical value chain into the next stage of the Flavour and Fragrance Industry (i.e. Step 2).

Specific strategic recommendations

- 1 Promote education and skills development in the downstream flavour and fragrance industry and the complementary industries of cosmetics and nutraceuticals. South African tertiary institutions should therefore provide courses in cosmetics and flavour and fragrance formulation.
- 2 Develop at least one regional centre of excellence in each of the areas of flavour and fragrances, cosmetics and nutraceuticals. These should take advantage of the synergies afforded by the presence of tertiary institutions (producing graduates in agriculture, botany, chemistry, pharmacology and having laboratory facilities etc.)