A novel process for making monomer used in producing Polybenzimidazole (PBI)–a specialty/engineering polymer

EXECUTIVE SUMMARY

A process for production of high yielding, very pure 3,3',4,4'- Tetraamino biphenyl (TAB) monomers, which are used for preparing polybenzimidazole (PBI) polymers.

BACKGROUND

TAB monomer is a valuable intermediate and end product in various areas. The current methods of production fall short in either achieving high yields or have impurities (presence of copper or its salts) in the end product. Also, some raw materials used are known carcinogens. Some processes also require high temperature and pressure–hence increasing the cost of production.

TECHNOLOGY DESCRIPTION

NCL scientists have developed a novel process for the preparation of highly pure TAB monomer, having large yields. The raw materials used are non-carcinogenic, unlike what the conventional methods use (e.g., benzidine). The reactions can be carried out at milder temperature (<100 °C) and pressure (250 psig). New, efficient and renewable catalysts for this process have also been developed. TAB monomer produced by this method does not contain any copper contaminants and no by-products are formed.

MARKET POTENTIAL

- Global specialty fibers market is expected to increase in size to over $9.2 billion in 2012; out of which the market share of PBI fibers will be about $111 million in 2012 (increasing at a CAGR of 12.3% from $62 million in 2007)*
- Furthermore, global fuel cells (where PBI membranes are used extensively) market is expected to grow from $650 million in 2011 to $1.6 billion in the year 2016.**

*http://www.redorbit.com/news/technology/1170230/bcc_research_report_states_global_market_for_specialty_fibers_worth/index.html (viewed 12/11/11),
**http://www.marketsandmarkets.com/Market-Reports/fuel-cell-market-348.html (viewed 23/01/12)

VALUE/ADVANTAGES

- The purity of TAB is greater than 98%
- The raw materials used in this process are non-carcinogenic and cheap
- Copper and its salts are not formed along with TAB, making TAB obtained highly pure
- The reaction conditions are less harsh as compared to the currently available processes (lower temperatures and pressures – hence lower production costs)

APPLICATIONS

- TAB is used as a monomer in the production of PBI polymers, which are known for their excellent mechanical and thermal stability – and are widely used in engineering and flame-retardant applications
- PBI membranes are used in fuel cells
- TAB is also used as an anti oxidant and as an agent for stabilizing epoxy resins

TECHNOLOGY STATUS

- Demonstrated at the lab scale
- On the lookout for potential partners licensing
- Patents filed/granted: US # 6979749 B2, US # 6835854 B2, US # 2009/0131678 A1, EP # 1727781

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