

A Step Towards Circular Economy: Assessing the Efficacy of Ion Exchange Resins in the Recycling of Automotive Engine Coolants

Authors : George Madalin Danila, Mihaiella Cretu, Cristian Puscasu

Abstract : The recycling of used antifreeze/coolant is a widely discussed and intricate issue. Complying with government regulations for the proper disposal of hazardous waste poses a significant challenge for today's automotive and industrial industries. In recent years, global focus has shifted toward Earth's fragile ecology, emphasizing the need to restore and preserve the natural environment. The business and industrial sectors have undergone substantial changes to adapt and offer products tailored to these evolving markets. The global antifreeze market size was evaluated at US 5.4 billion in 2020 to reach USD 5,9 billion by 2025 due to the increased number of vehicles worldwide, but also to the growth of HVAC systems. This study presents the evaluation of an ion exchange resin-based installation designed for the recycling of engine coolants, specifically ethylene glycol (EG) and propylene glycol (PG). The recycling process aims to restore the coolant to meet the stringent ASTM standards for both new and recycled coolants. A combination of physical-chemical methods, gas chromatography-mass spectrometry (GC-MS), and inductively coupled plasma mass spectrometry (ICP-MS) was employed to analyze and validate the purity and performance of the recycled product. The experimental setup included performance tests, namely corrosion to glassware and the tendency to foaming of coolant, to assess the efficacy of the recycled coolants in comparison to new coolant standards. The results demonstrate that the recycled EG coolants exhibit comparable quality to new coolants, with all critical parameters falling within the acceptable ASTM limits. This indicates that the ion exchange resin method is a viable and efficient solution for the recycling of engine coolants, offering an environmentally friendly alternative to the disposal of used coolants while ensuring compliance with industry standards.

Keywords : engine coolant, glycols, recycling, ion exchange resin, circular economy

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