Low Charge Natural Refrigerant Systems in the context of Montreal and Kyoto Protocols

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Abstract

The need for natural refrigerants has been a major topic of discussion because of the Ozone Depletion Potential (ODP) and the Global Warming Potential (GWP). Scientists and governmental agencies worldwide have been addressing their concerns regarding these two important issues and have been actively pursuing to device policies to reduce the environmental effects of ever increasing industrial activities. The Montreal Protocol was implemented on January 1, 1989 to control the use of various synthetic refrigerants, such as R-11, R-12 and other CFC's and HCFC's due to their higher ODP levels and the Kyoto Protocol was enforced on February 16, 2005 which promotes the use of those refrigerants that have an insignificant effect on the global warming. With these two binding laws implemented there is literally no economically viable refrigerant available in the market that can be considered as a work horse for the next fifty years. Global chemical industry is struggling to find alternate synthetic gases that would fall within the requirements of these protocols. Various concoctions of HFO's are being developed and tested, however, there are two major issues. Firstly, these fluids and their blends are extremely expensive and secondly most of them are mildly flammable. In view of current circumstances the HVACR industry is seriously looking into the wider use of natural refrigerants such as ammonia, carbon dioxide and hydrocarbons that have zero or close to zero ODP and GWP. Nearly all the natural refrigerants are extremely inexpensive and possess superior transport properties as compared to the synthetic refrigerants; however, there are two drawbacks, toxicity and flammability. In order to overcome this hurdle it is essential that enhanced surface methods be developed and introduced to reduce the refrigerant charge in systems. Halocarbon industry has expended enormously amount of time and money in developing ultra-high efficiency heat exchangers. This experience and knowledge is available and could be applied in developing efficient exchangers for natural refrigerant applications too. This presentation provides an over view of the status of natural refrigerants and discusses the present and the future trends in the development of compact low-charge systems. Developing economies especially those with developed hydrocarbon industry and/or agro based industry such as Iran will benefit by adopting the "natural route".