

Carbon Dioxide Accounting – Sulfur Hexafluoride-Tagging of Supercritical CO₂ to Demonstrate Viability of ¹⁴CO₂-Tagging for Sequestration

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Carbon sequestration is expected to be a key technology in the effort of stabilizing atmospheric greenhouse gas concentrations at levels that limit global temperature rises to 2°C by 2050, as recommended by the United Nations Intergovernmental Panel on Climate Change. In order to improve public acceptance of the technology and to understand long term interaction of sequestered CO₂ with its environment, quantitative inventory keeping is crucial. The ability to safely tag an injection stream with ¹⁴CO₂ will help studying the gases interaction with its environment through sediment analysis from monitoring wells around the injection site. The main challenge is to inject very small quantities of tracer gas at a constant rate into a high pressure system. Here we study methods to tag supercritical CO₂ with sulfur hexafluoride (SF₆) in the laboratory. Supercritical CO₂ at 32°C and 76 bar pressure is circulated at a turbulent flow rate in a closed flow loop to simulate an injection well. Because of its resistance to compression, water is a good injection medium for the tracer gas. In a membrane system, we extract all gases from deionized water and subsequently expose it to a controlled atmosphere of SF₆ and CO₂. Controlling temperature and pressure, it is then enriched to a known concentration of the tracer gas and retained in 500µL cartridges. When injecting the content of one cartridge at a rate of 10µL per minute, we see a linear increase of SF₆-concentration in the flow loop, leveling off after all tracer has been injected.