

# DNA TRACERS FOR SUBSURFACE APPLICATIONS IN THE OIL AND GAS INDUSTRY

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Robust chemical flow tracer systems to map fluid flow and fluid distributions<sup>[1]</sup> for various geological reservoirs or to trace wastewater effluent leakage<sup>[2]</sup> from landfill sites or contaminated surface water are in increasing demand. Chemical flow tracers are often used in the oil & gas industry, for instance in hydraulic fracturing treatments, to map fluid flow or to obtain information about the reservoir geology, connectivity and efficiency of drilling sites. Well-specified tracers can be added to hydraulic fluid systems but have to survive the hydraulic fracturing conditions. These tracers should give a complete picture about the connectivity and efficiency of different drilling sites. We present our efforts to develop a robust DNA-based tracer system. DNA was encapsulated in cross-linked polystyrene. To do so, synthetic single stranded DNA (ssDNA) was protected, transferred from the aqueous phase into a monomer phase, which was emulsified and subsequently polymerized to yield nanoparticles. The DNA tracer can be selectively recovered from the cross-linked polymer nanoparticles by Raney-Nickel mediated hydrogenation of the cross-links. The released ssDNA was qualified and quantified using quantitative real-time Polymerase Chain Reaction (qPCR).

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[1] Hubbert, M.K. and Willis, D.G., *Mechanics Of Hydraulic Fracturing*, 1972, Society of Petroleum Engineers.

[2] Gasser, G.; Rona, M.; Voloshenko, A.; Shelkov, R.; Lev, O.; Elhanany, S.; Lange, F.T.; Scheurer, M.; and Pankratov, I., *Evaluation of micropollutant tracers. II. Carbamazepine tracer for wastewater contamination from a nearby water recharge system and from non-specific sources*. Desalination, 2011, **273**(2–3), p. 398-404.