Supplementary Materials: Design and Development of Novel Continuous Flow Stirred Multiphase Reactor: Liquid-Liquid-Liquid Phase Transfer Catalysed Synthesis of Guaiacol Glycidyl Ether

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1. Reactor photo and diagrams

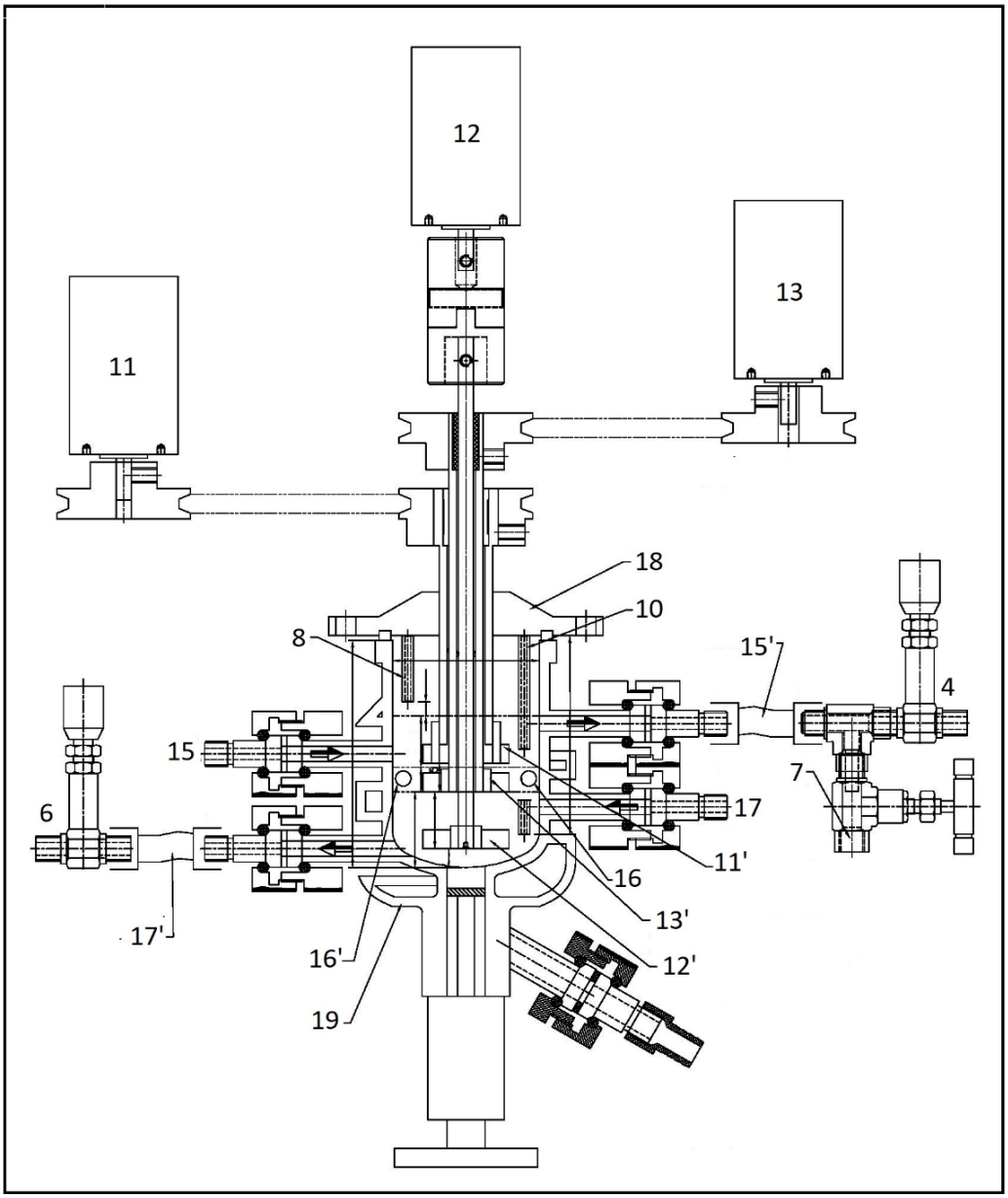


Figure 1. Schematic diagram of the front section the reactor vessel.

4- organic phase metering valve, 6- aqueous phase metering valve, 7- sampling valve for organic phase, 8- overflow tube, 10 adjustable sampling tube with feed system, 11- motor for organic phase, 12- motor for aqueous

phase, 13- motor for middle phase, 11′- stirrer for organic phase, 12′- stirrer for aqueous phase, 13′-stirrer for middle phase, 15- inlet for organic phase, 16- inlet for middle phase, 17- inlet for aqueous phase, 15′- outlet for organic phase, 16′- outlet for middle phase, 17′- outlet for aqueous phase, 18- jacketed heating system, 19- drain valve.

Figure 2. Front view of the actual reactor vessel.

4- organic phase metering valve, 5- middle phase metering valve, 6- aqueous phase metering valve, 8- overflow tube, 10 adjustable sampling tube with feed system, 11- motor for organic phase, 12- motor for aqueous phase, 13- motor for middle phase, 14- reactor glass vessel, 15- inlet for organic phase, 16- inlet for middle phase, 17- inlet for aqueous phase, 15′- outlet for organic phase, 18- jacketed heating system, 19- drain valve.

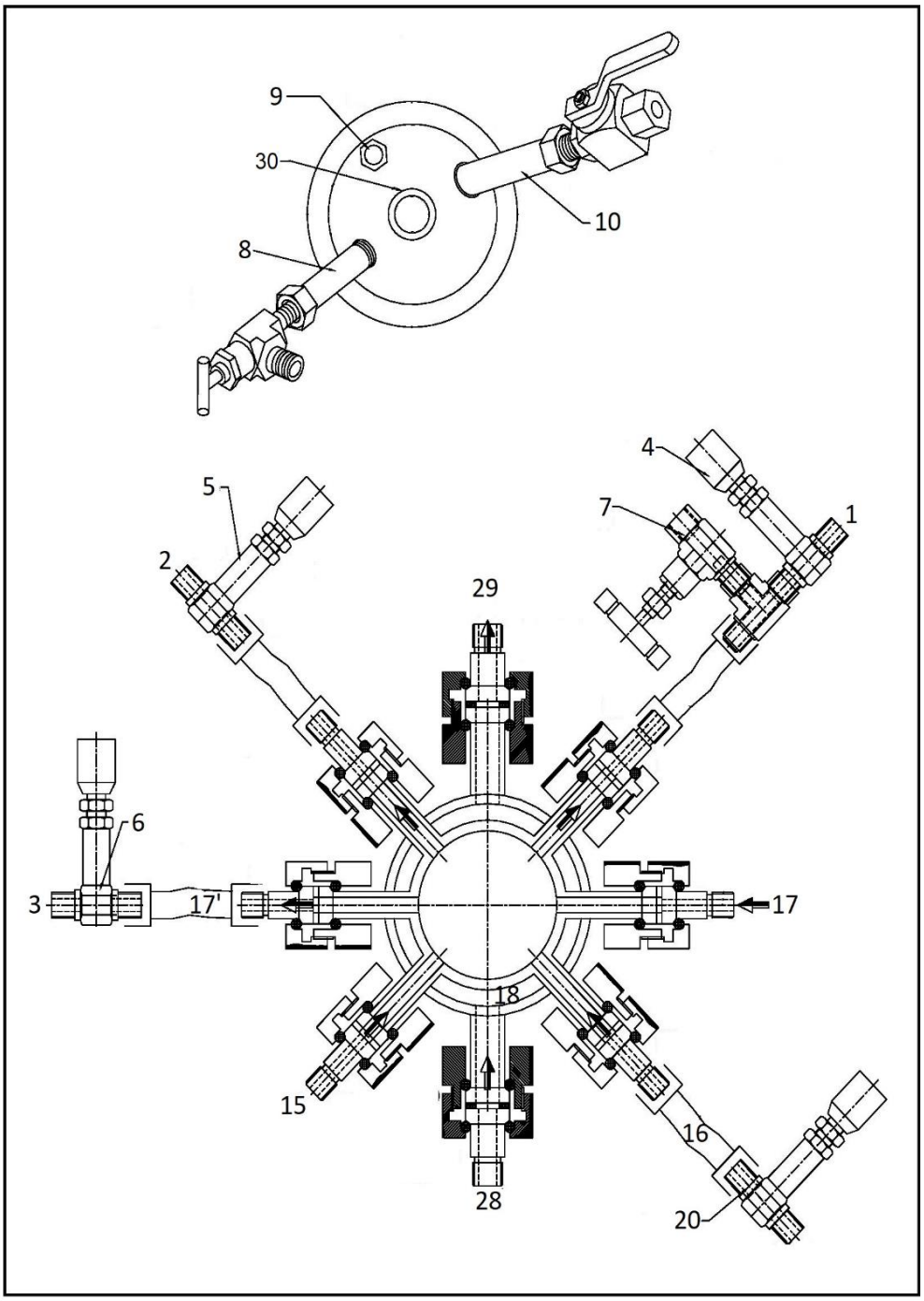


Figure 3. Schematic diagram of a top view of the reactor vessel.

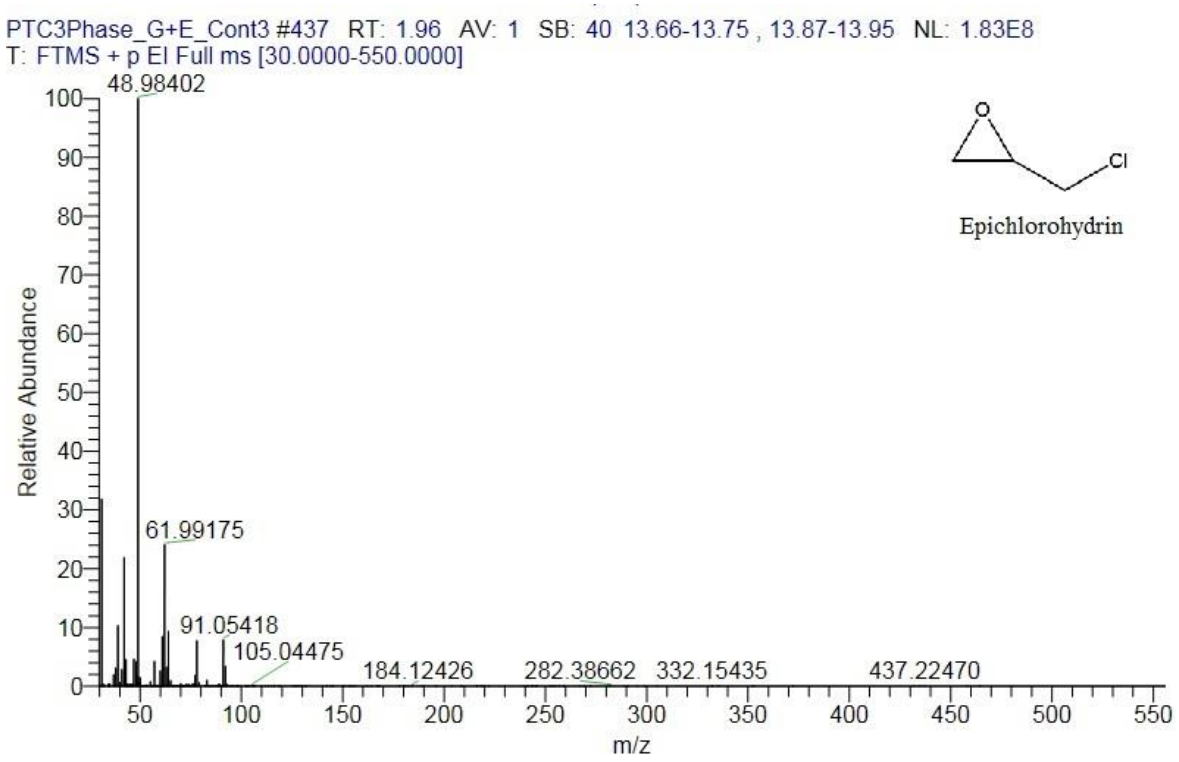
1-outlet for organic phase metering valve, 2- outlet for middle phase metering valve, 3- outlet for aqueous phase metering valve, 4- organic phase metering valve, 5- middle phase metering valve, 6- aqueous phase metering

valve, 7- sampling valve for organic phase, 8- overflow tube, 9- thermowell with thermocouple, 10 adjustable sampling tube with feed system,15- inlet for organic phase, 16- inlet for middle phase, 17- inlet for aqueous phase, 15′- outlet for organic phase, 16′- outlet for middle phase, 17′- outlet for aqueous phase, 18- jacketed heating system, 20- metering valve at middle phase inlet, 28- jacket heating media in, 29- jacket out heating media out, 30- stirrer assembly hole.

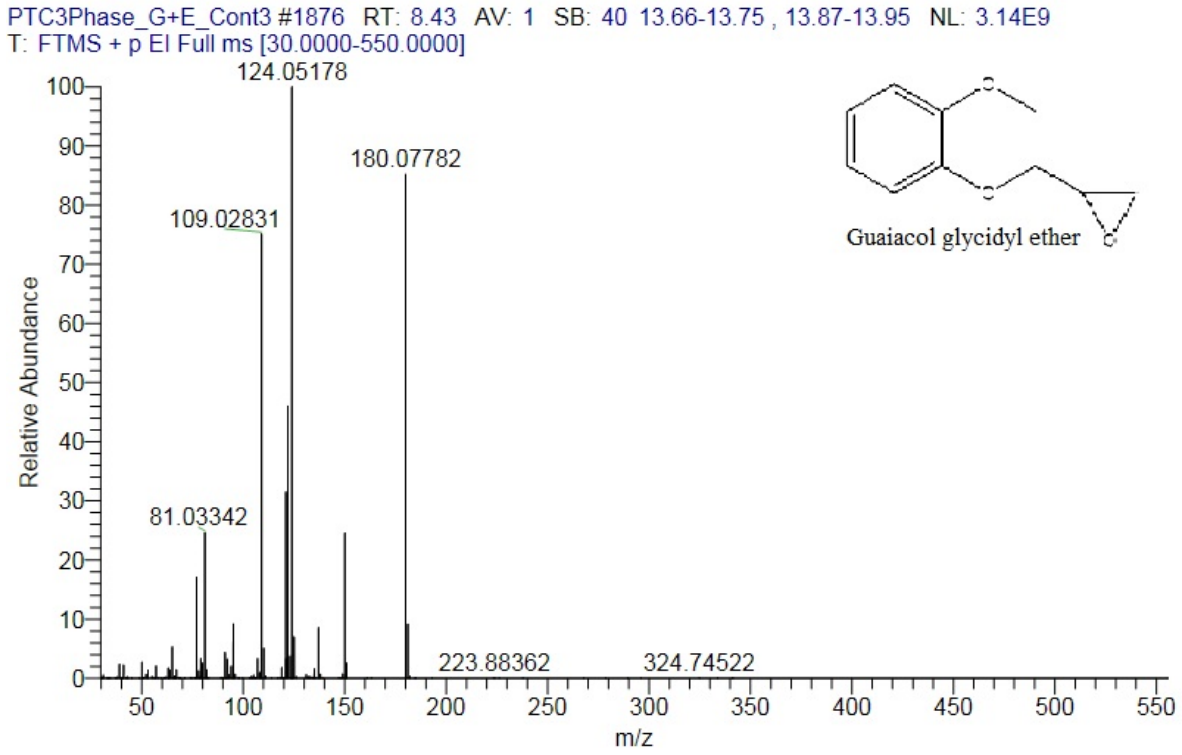
2. GCMS analysis

The Thermo Scientific Q Exactive Orbitrap GC-MS (HRMS) was used for the confirmation of the product. Following were the MS spectrums for all the GC peaks including A) Epichlorohydrin, B) Guaiacol glycidyl ether, C) reaction by-product and D) n-decane.

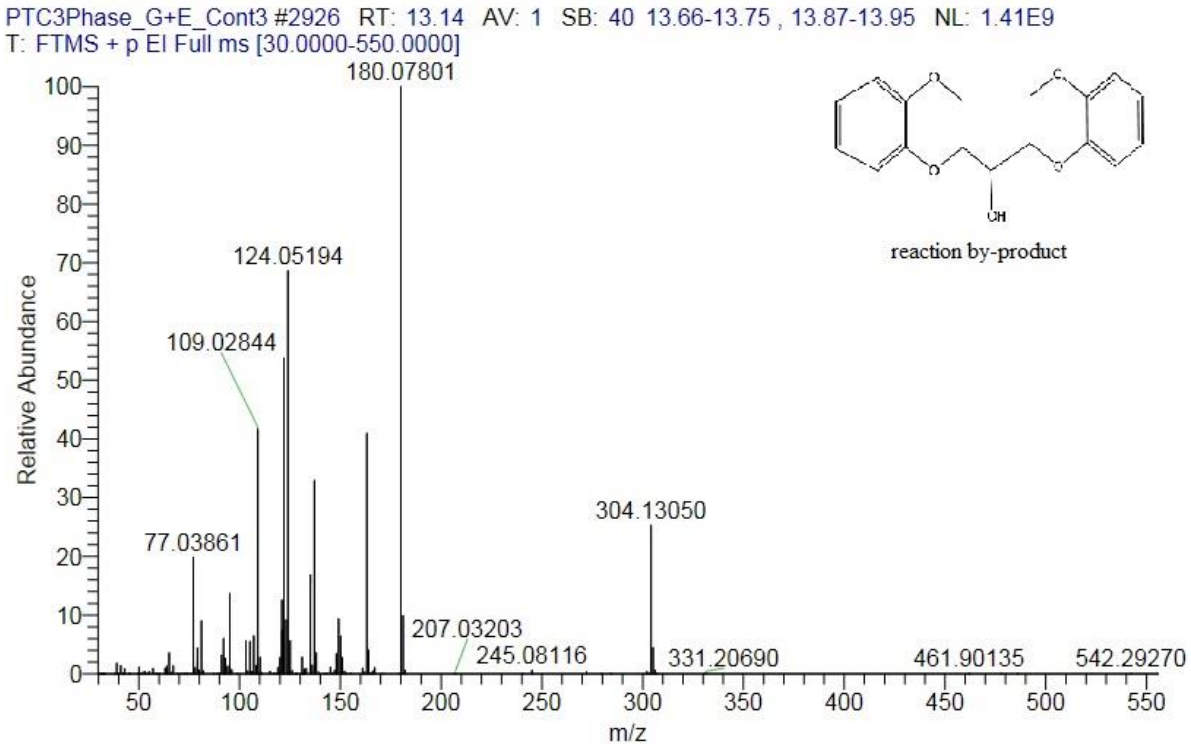
A) Epichlorohydrin



B) Guaiacol glycidyl ether



C) Reaction by-product



D) n-decane.

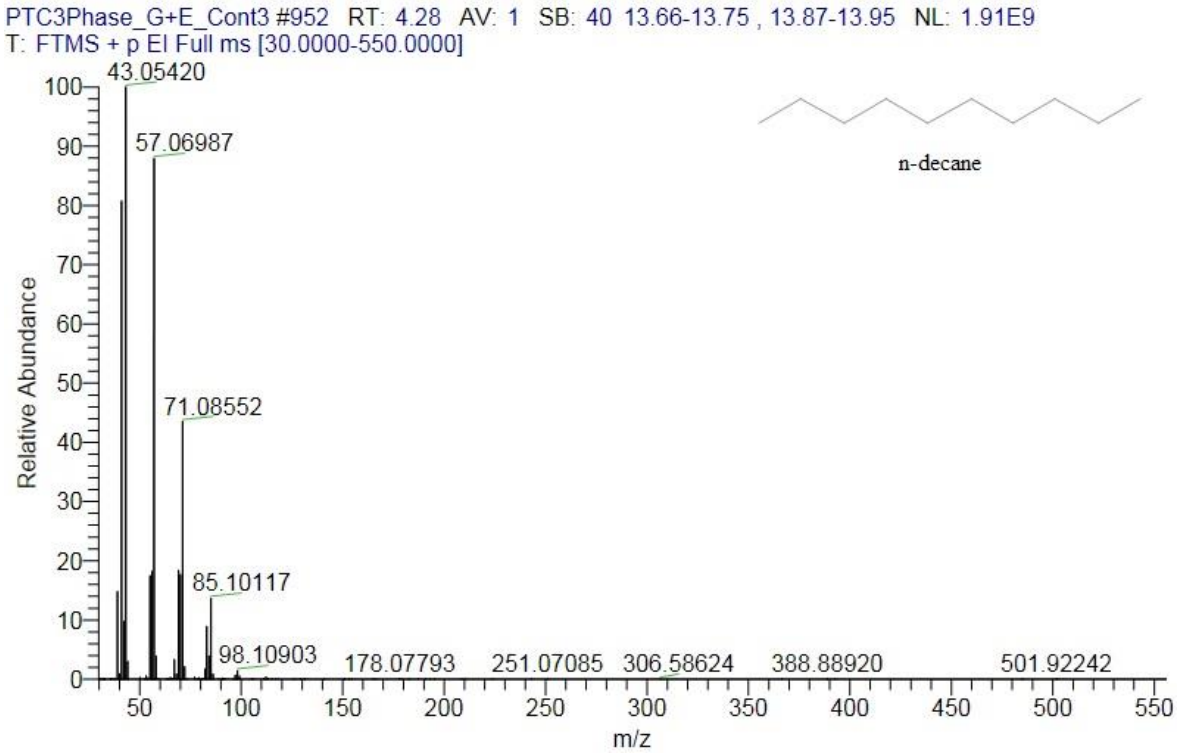


Figure 4. GCMS spectra of A) Epichlorohydrin, B) Guaiacol glycidyl ether, C) reaction by-product and D) n-decane

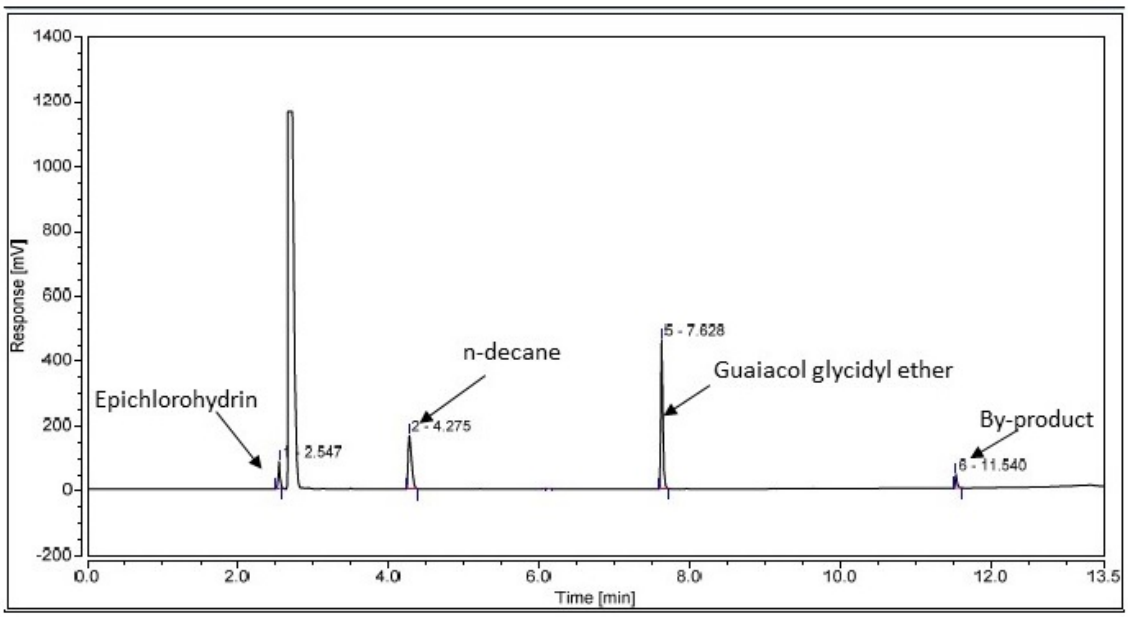


Figure 5. Typical GC chromatogram of reaction mass.