**Nuclear magnetic Resonance Spectroscopy (NMR)**

*Proton* nuclear magnetic resonance spectroscopy: 1H NMR was performed on a Bruker AVANCE instrument at 400.13 MHz in D2O solvent with solvent suppression (zgpr). Chemical shifts were referenced to water at 4.8 ppm. Spectra (Figure 1) were similar to prior spectra collected on HMWDOM with major peaks at 5.21 ppm (O-C-O), 3.75 ppm (68%; H-C-OH), 2.77 ppm (2%; C-N-CH3), 2.04 ppm (11%; OOC-CH3), and 1.29 ppm (20%; O-C-CH3).

*Carbon-13* NMR spectra were collected with broad-band decoupling at 100.61 MHz in D2O and a 200 Hz line broadening. Spectra (Figure 2) were similar to prior solid state spectra collected on HMWDOM with major peaks at 174.8 ppm (8%; O=C-N), 101.6 ppm (8%; O-C-O), 70.8 and 61.5 ppm (71%; H-C-OH; H-C-NH; C-O-CH3), 22.7 ppm (NOCCH3), and 16.7 ppm (O-C-CH3). Peaks at 22.7 ppm and 16.7 ppm contributed 12% of total carbon.

*Phosphorus-31* NMR spectra were collected with broad-band decoupling at 161.98 MHz in D2O. Spectra (Figure 3) were similar to prior solid-state spectra collected on HMWDOM referenced to phosphate at 0 ppm with major peaks at 27.8 and 23.7 ppm (23% total area; C-P (phosphonate), 0 ppm (64%; C-O-P (phosphate and phosphate esters), and -10.2 ppm (14%; O-P-O-P (pyrophosphate))

*Heteronuclear Single Quantum Coherence (HSQC) spectroscopy*. 13C/1H heteronuclear correlation spectra (Figure 4 and 5) show strong cross peaks for fucose (15. 96 x 1.98 ppm) and rhamnose (17.23 x 1.25 ppm), N-acetyl amino sugars (H-C-N(O)C-**C**H3; 22.76 x 2.04 ppm and , H-**C**-N(O)C-CH3; 56.0 x 3.40 ppm and 58.4 x 3.36 ppm), and O-methyl sugars (C-O-**C**H3; 60-63 x3.47- 3.74 ppm).