Supporting information for

Studies on Dissolution of Carbohydrates in Ionic Liquids and Extraction from Aqueous Phase

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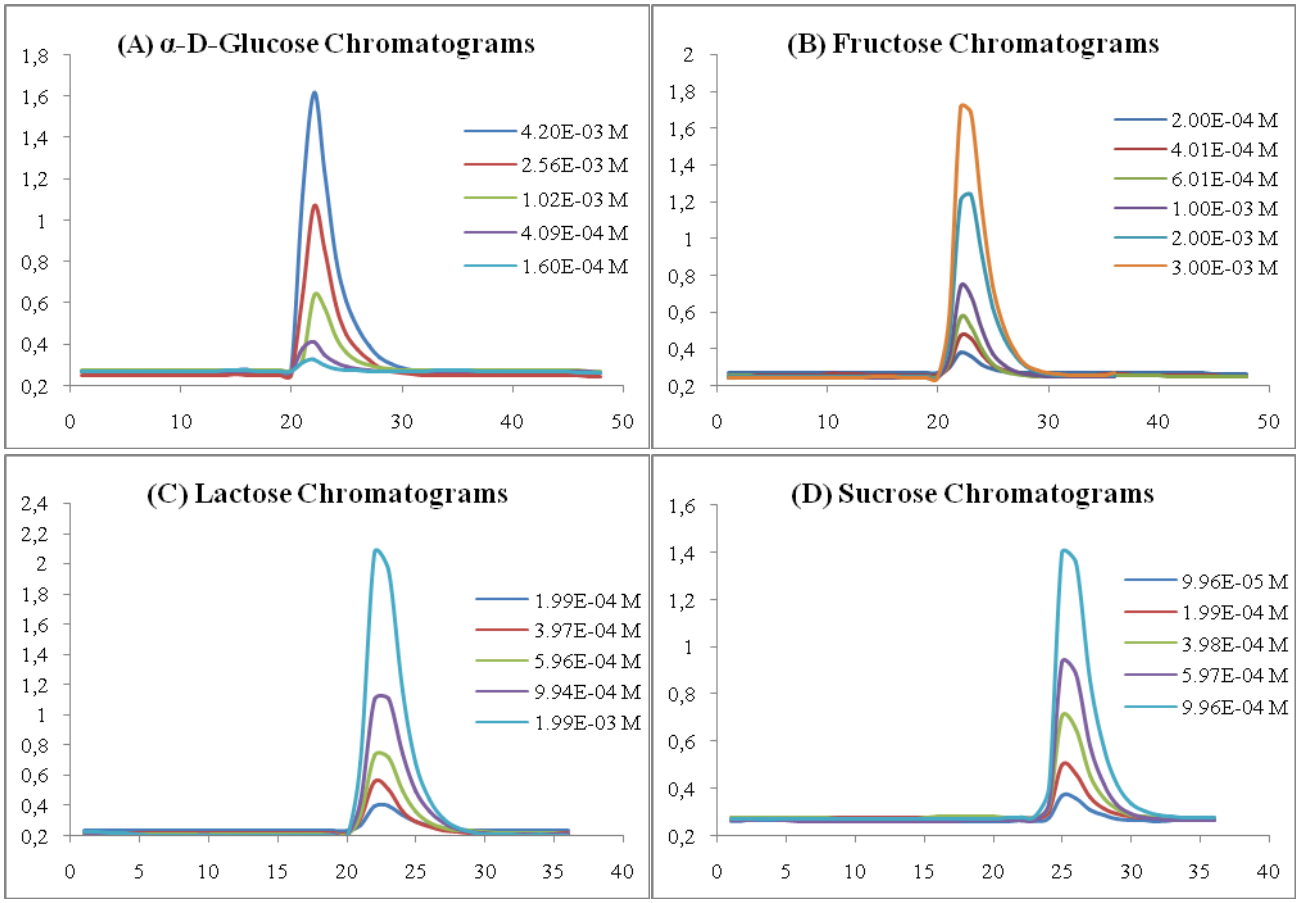

Figure 1 – HPLC chromatograms of glucose **(A)**, fructose **(B)**, lactose **(C)** and sucrose **(D)**, for different carbohydrates concentrations. HPLC analysis was made using a reverse phase C18 column (Hichrom, Lichrosorb RP18-5, 25cm×4.6mm id) and a refractive index detector; the mobile phase was water (100%) with a flow rate of 1.0 mL/min.

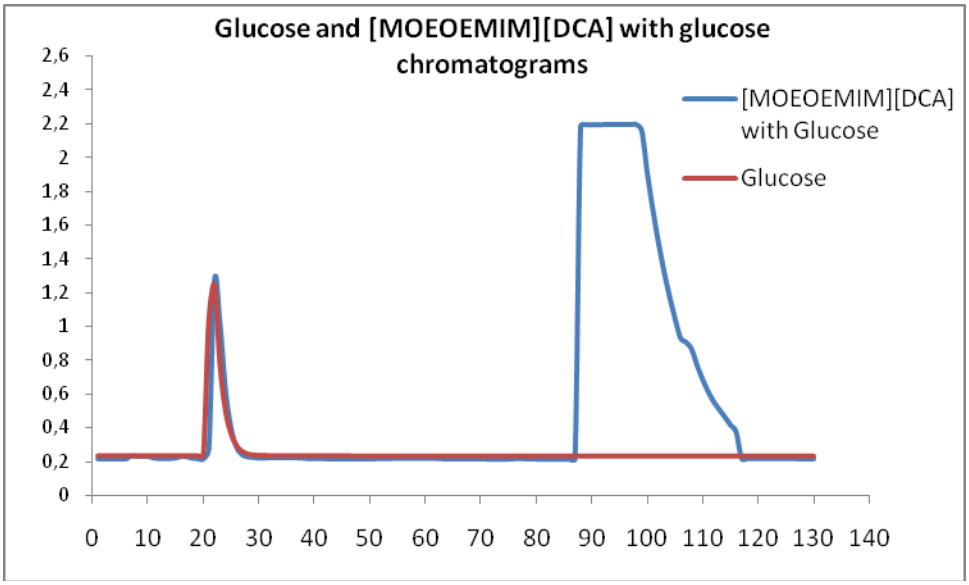

Figure 2 – HPLC chromatograms of glucose and [MOEOEMIM][DCA] with glucose dissolved. HPLC analysis was made using a reverse phase C18 column (Hichrom, Lichrosorb RP18-5, 25cm×4.6mm id) and a refractive index detector; the mobile phase was water (100%) with a flow rate of 1.0 mL/min.

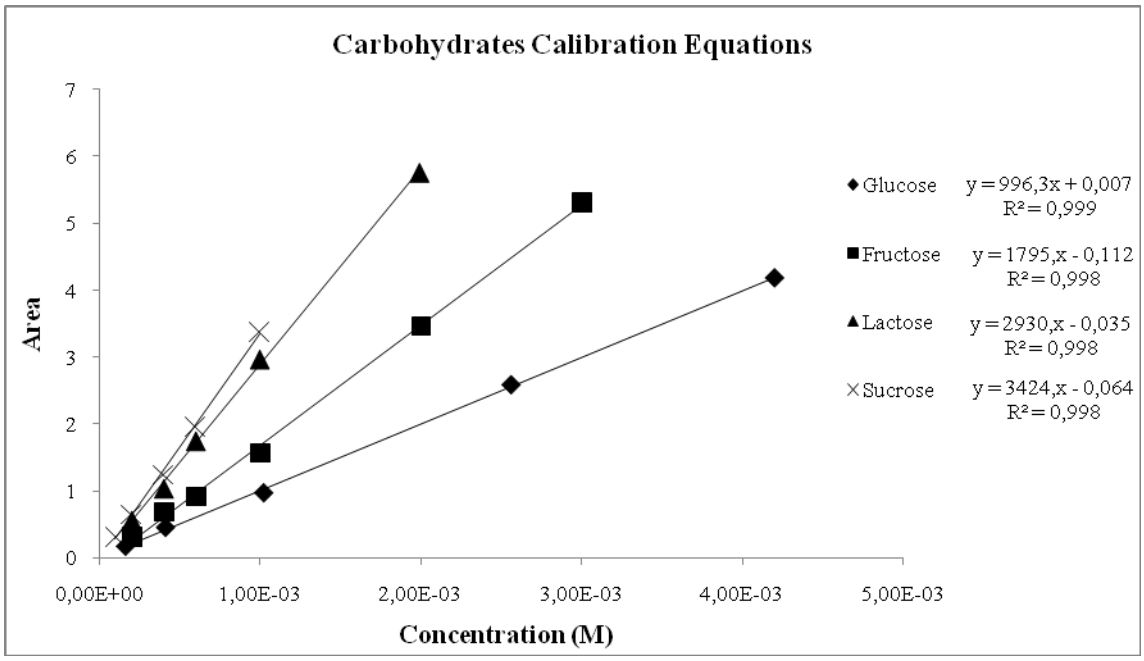

Figure 3 – Calibration equations for glucose, fructose, lactose and sucrose, made from the area calculation of each chromatogram with different carbohydrate concentration.

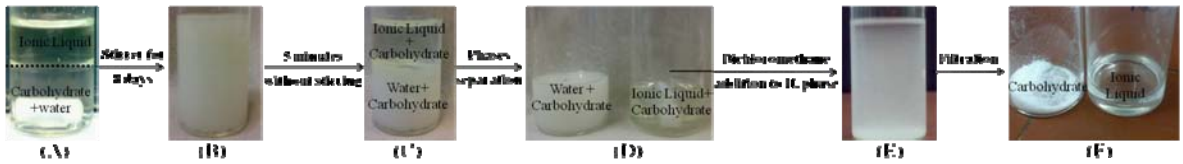

Figure 4 – Scheme of the extraction experiments (photographs of example made for the extraction of glucose from the IL [Aliquat®][Cl]). The sugar (or sugar mixture) is dissolved in the aqueous solution (A), and mixed with the hydrophobic IL for one week (B). The two phases are separated (C). Dichloromethane is added to the organic layer (D), in which sugar (or sugar mixture) dissolved in the IL precipitate immediately (E). Following filtration and washing with dichloromethane the sugar (or sugar mixture) recovered shows no trace of IL (F). After evaporation of the solvent, the IL is recovered without any traces of carbohydrates (F), and can be recycled for, at least, three times (the recycling experiments was made only with the [(di-*h*)$_2$DMG][DCA]).

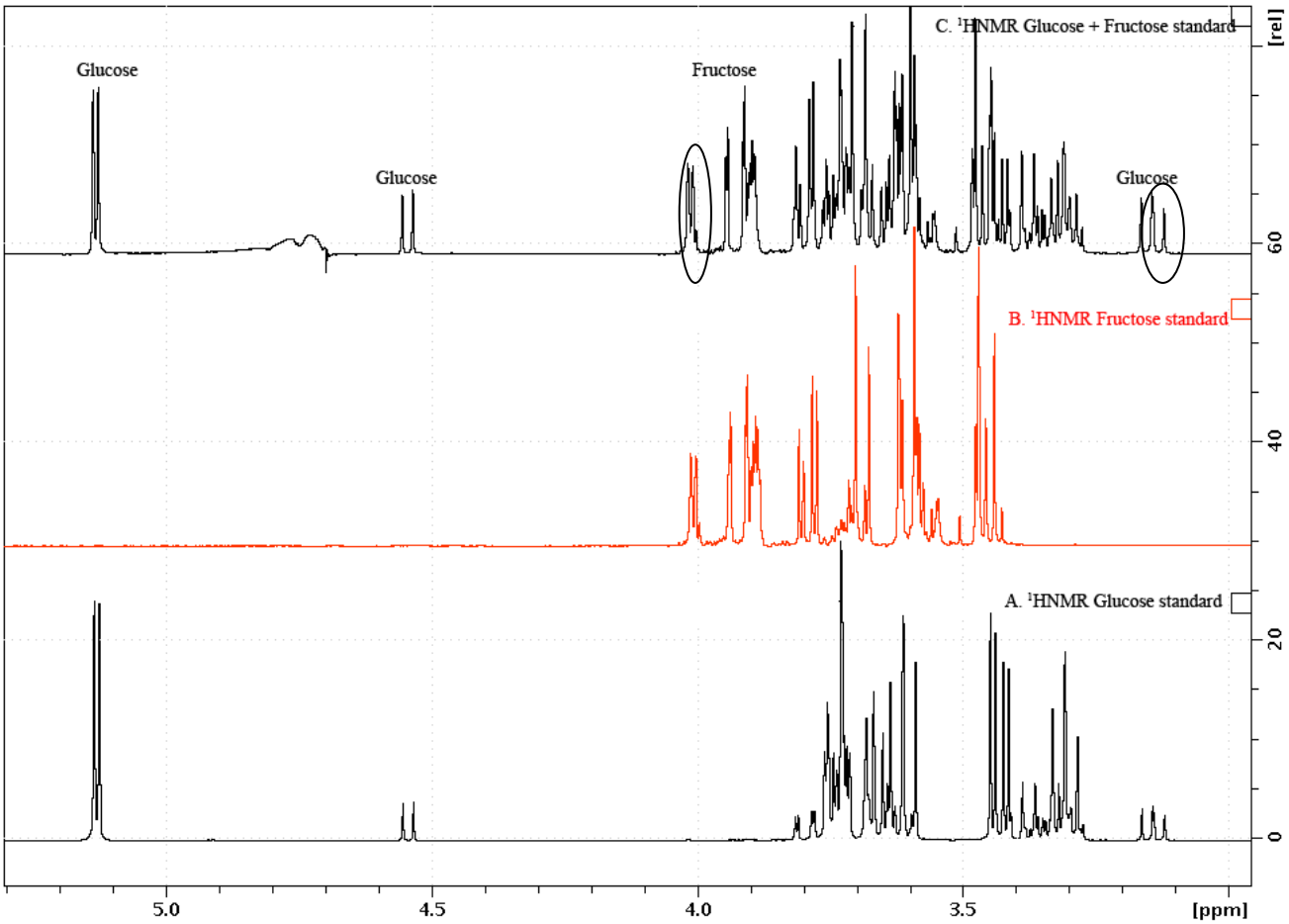

Figure 5 – ^{1}HNMR spectrum of monosaccharide glucose **(A)**, monosaccharide fructose **(B)** and a mixture glucose and fructose (1:1 wt.) **(C)**.

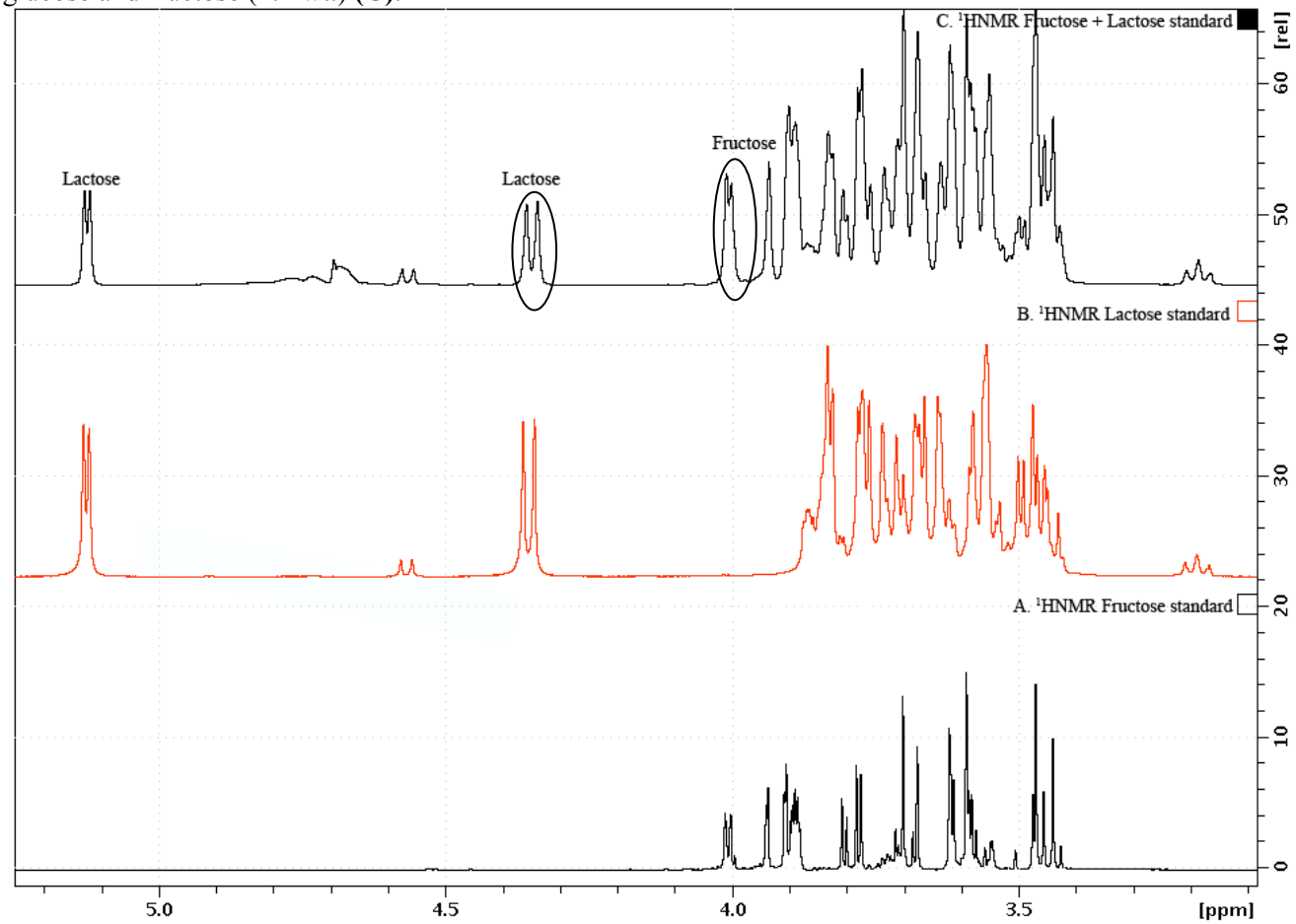

Figure 6 – ^{1}HNMR spectrum of monosaccharide fructose **(A)**, disaccharide lactose **(B)** and a mixture of fructose and lactose (1:1 wt.) **(C)**.

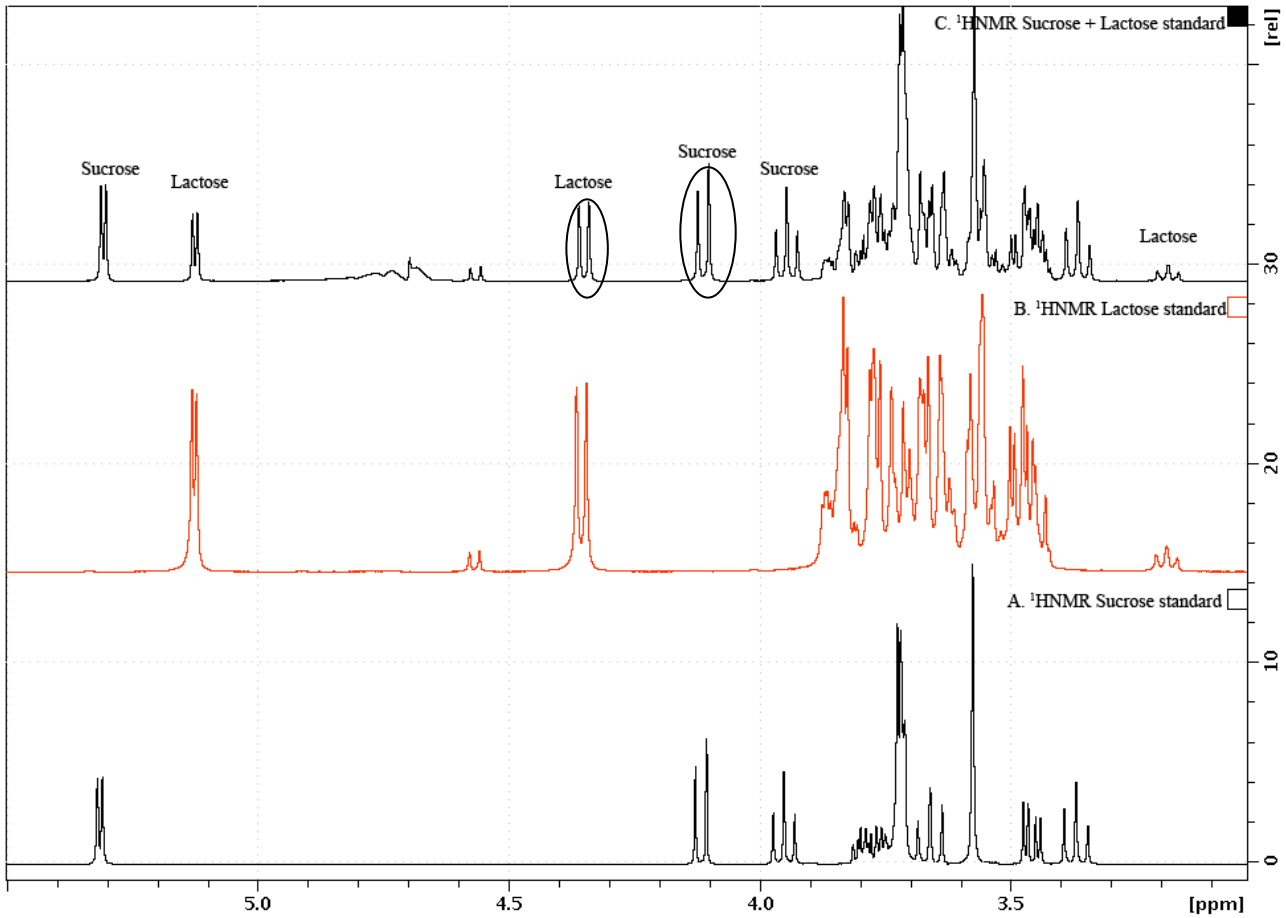

Figure 7 – ^{1}HNMR spectrum of disaccharide sucrose **(A)**, disaccharide lactose **(B)** and a mixture of sucrose and lactose (1:1 wt.) **(C)**.

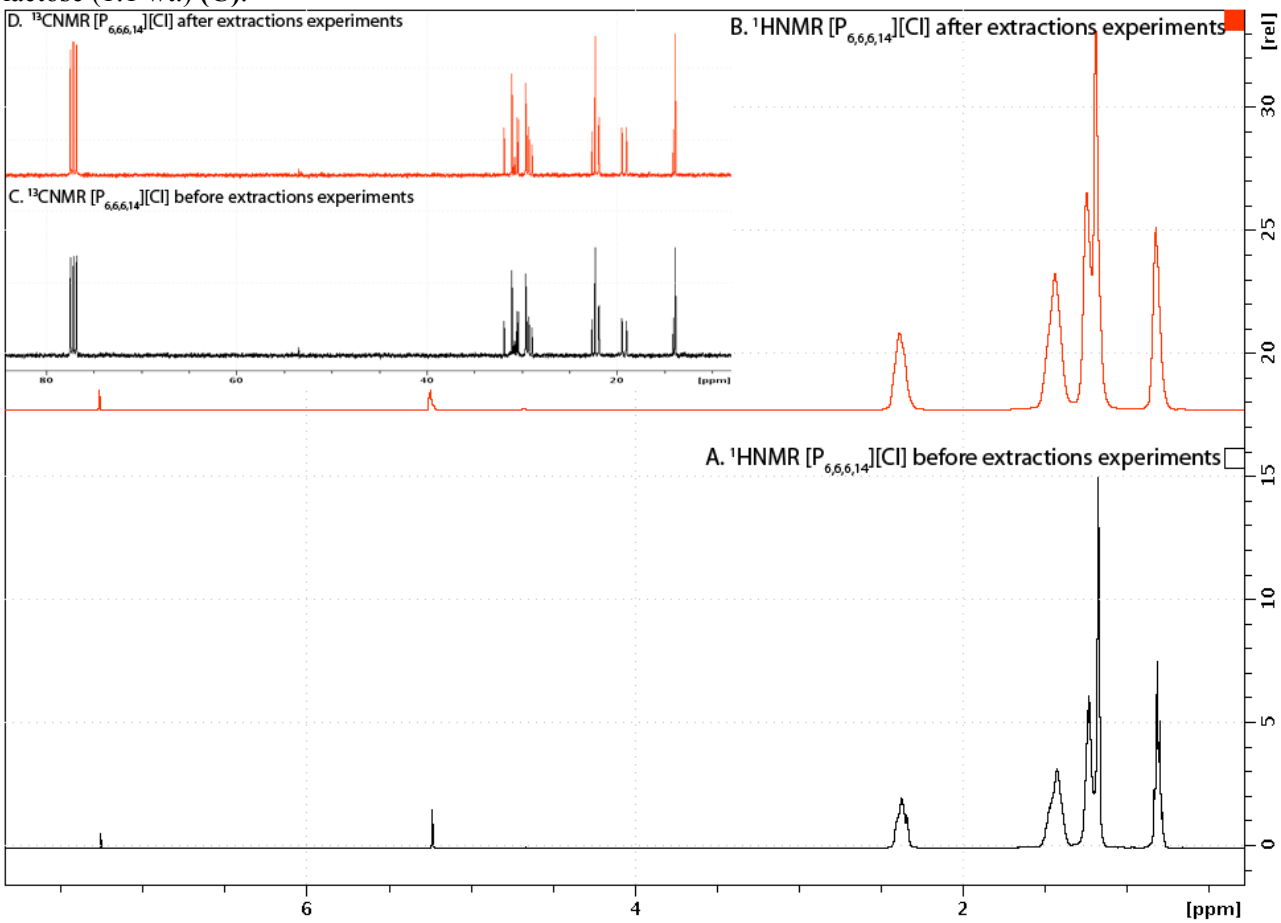

Figure 8 – The spectrum comparison of the IL $[P_{6,6,6,14}][Cl]$ before (**(A)** ^{1}HNMR and **(C)** ^{13}CNMR) and after (**(B)** ^{1}HNMR and **(D)** ^{13}CNMR) the extraction studies confirm the complete extraction of the carbohydrates from the IL phase.

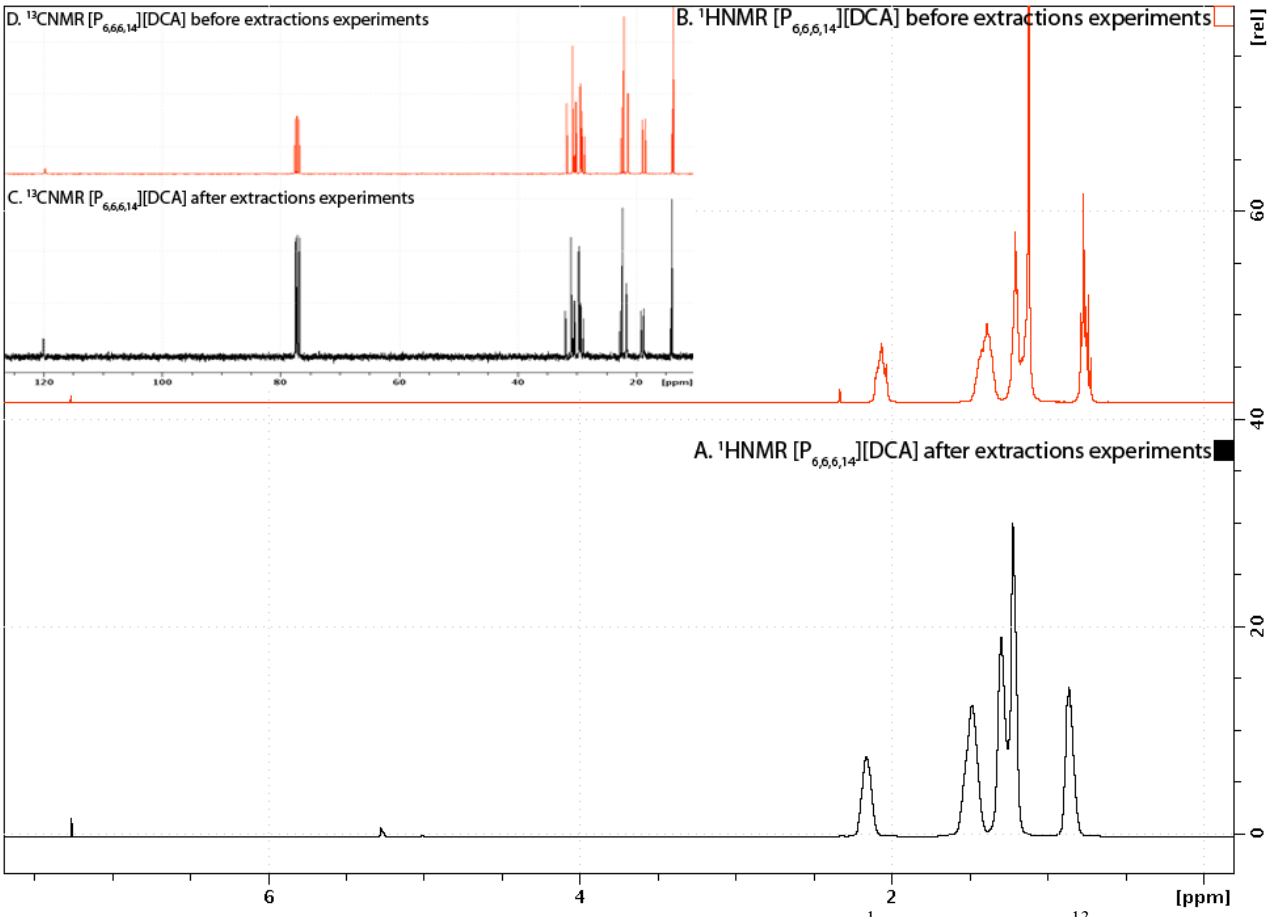

Figure 9 – The spectrum comparison of the IL $[P_{6,6,6,14}][DCA]$ before (**(B)** ^{1}HNMR and **(D)** ^{13}CNMR) and after (**(A)** ^{1}HNMR and **(C)** ^{13}CNMR) the extraction studies confirm the complete extraction of the carbohydrates from the IL phase.

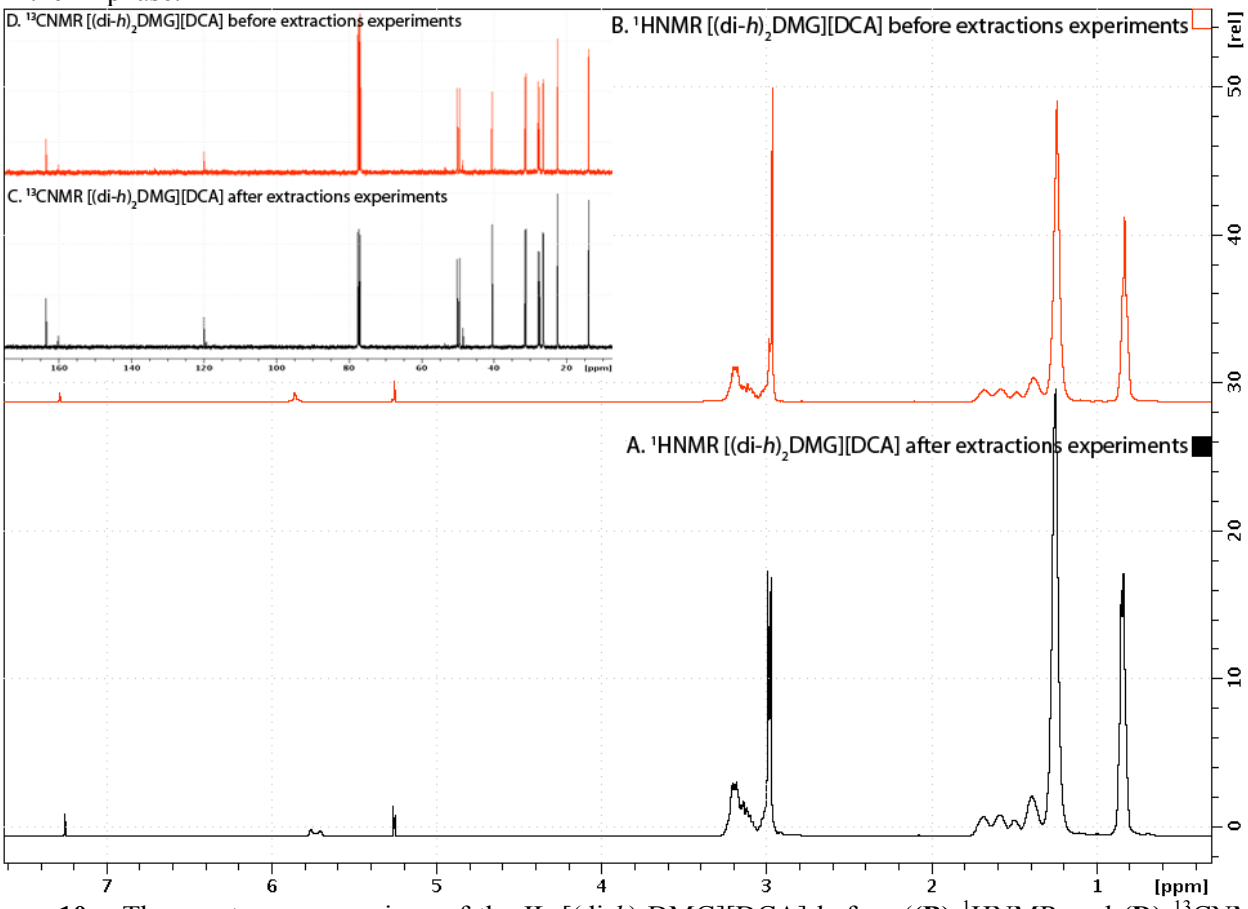

Figure 10 – The spectrum comparison of the IL $[(di\text{-}h)_2DMG][DCA]$ before (**(B)** ^{1}HNMR and **(D)** ^{13}CNMR) and after (**(A)** ^{1}HNMR and **(C)** ^{13}CNMR) the extraction studies confirm the complete extraction of the carbohydrates from the IL phase.

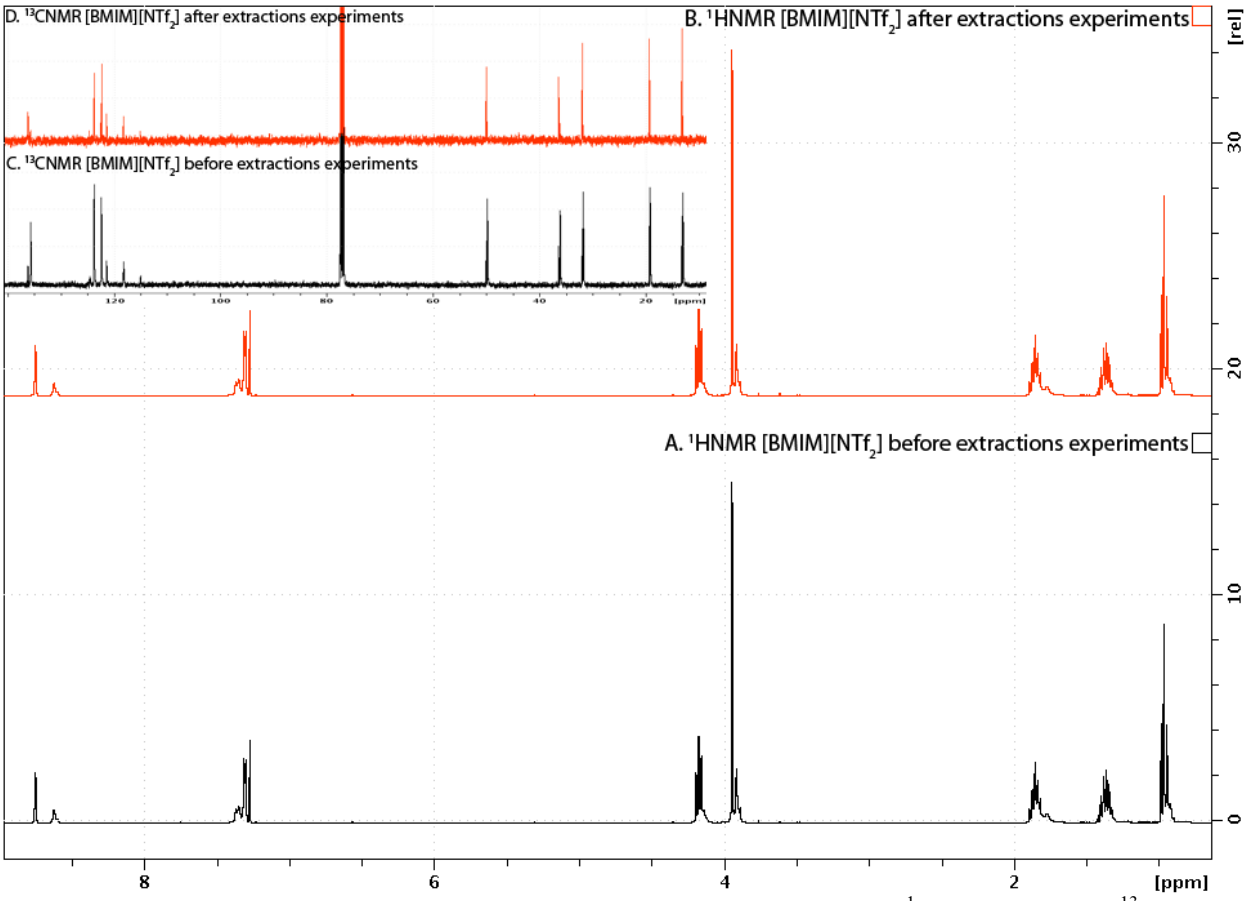

Figure 11 – The spectrum comparison of the IL [BMIM][NTf_2] before ((**A**) ^{1}HNMR and (**C**) ^{13}CNMR) and after ((**B**) ^{1}HNMR and (**D**) ^{13}CNMR) the extraction studies confirm the complete extraction of the carbohydrates from the IL phase.

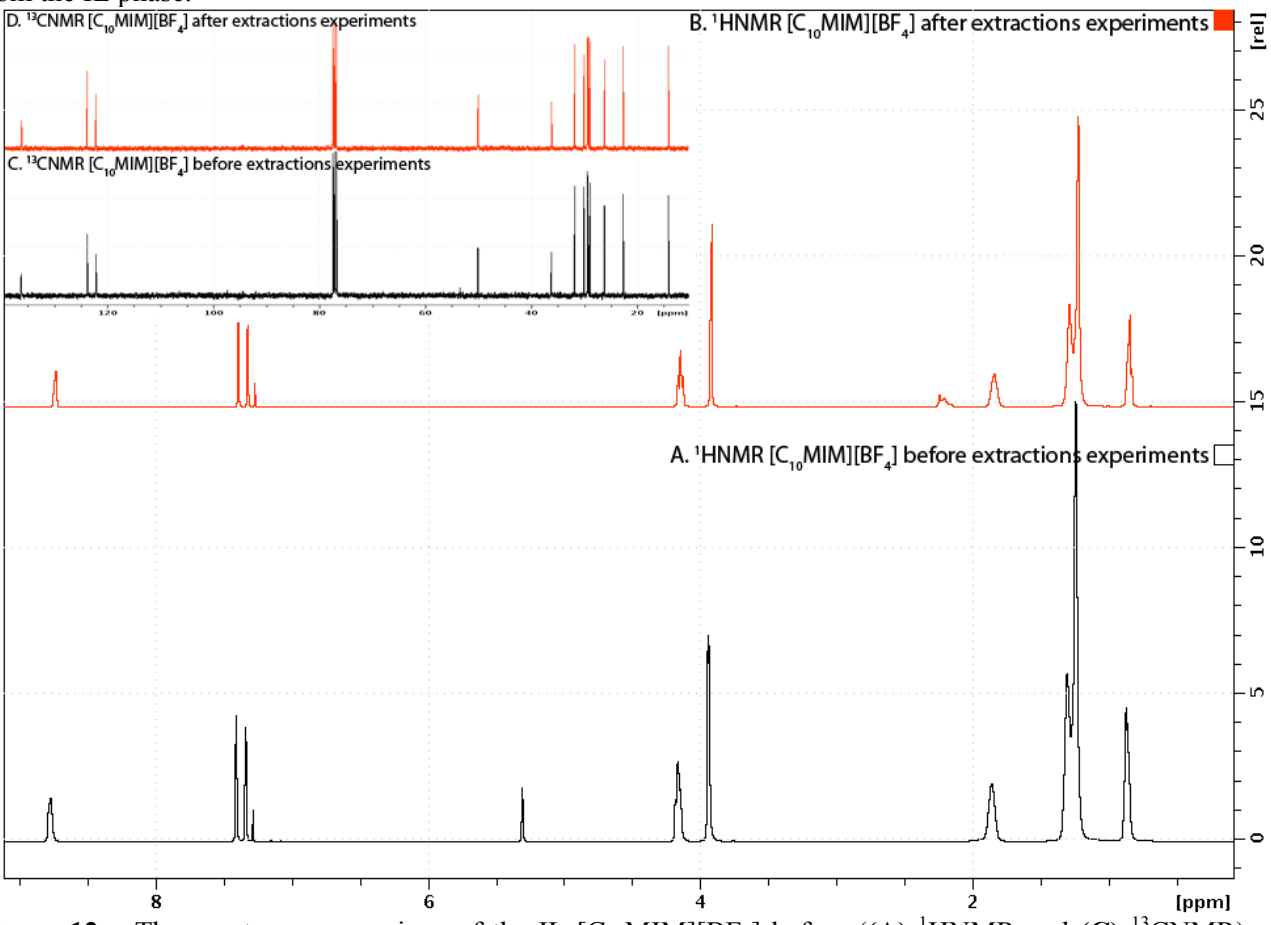

Figure 12 – The spectrum comparison of the IL [C_{10}MIM][BF_4] before ((**A**) ^{1}HNMR and (**C**) ^{13}CNMR) and after ((**B**) ^{1}HNMR and (**D**) ^{13}CNMR) the extraction studies confirm the complete extraction of the carbohydrates from the IL phase.

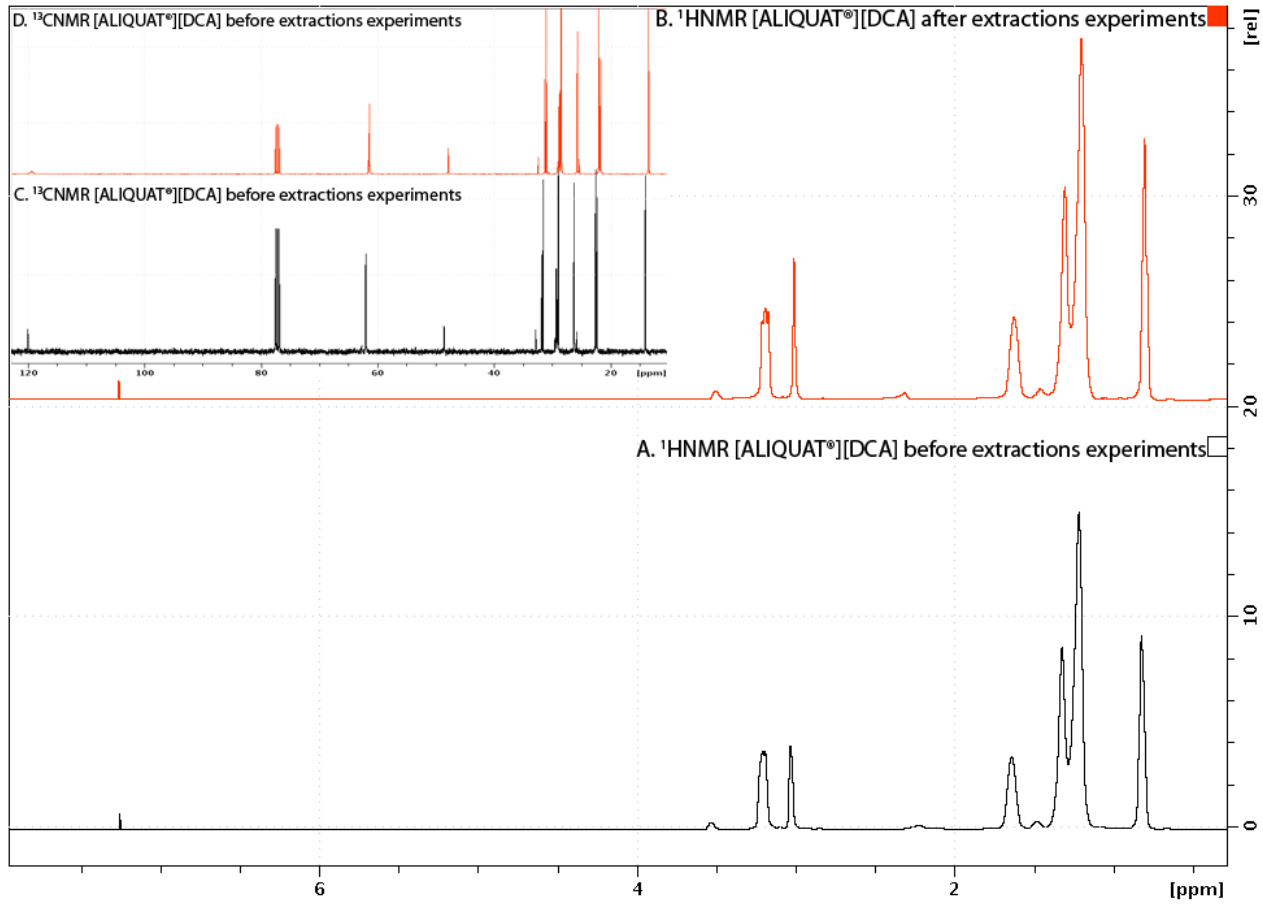

Figure 13 – The spectrum comparison of the IL [ALIQUAT®][DCA] before ((**A**) ^{1}HNMR and (**C**) ^{13}CNMR) and after ((**B**) ^{1}HNMR and (**D**) ^{13}CNMR) the extraction studies confirm the complete extraction of the carbohydrates from the IL phase.

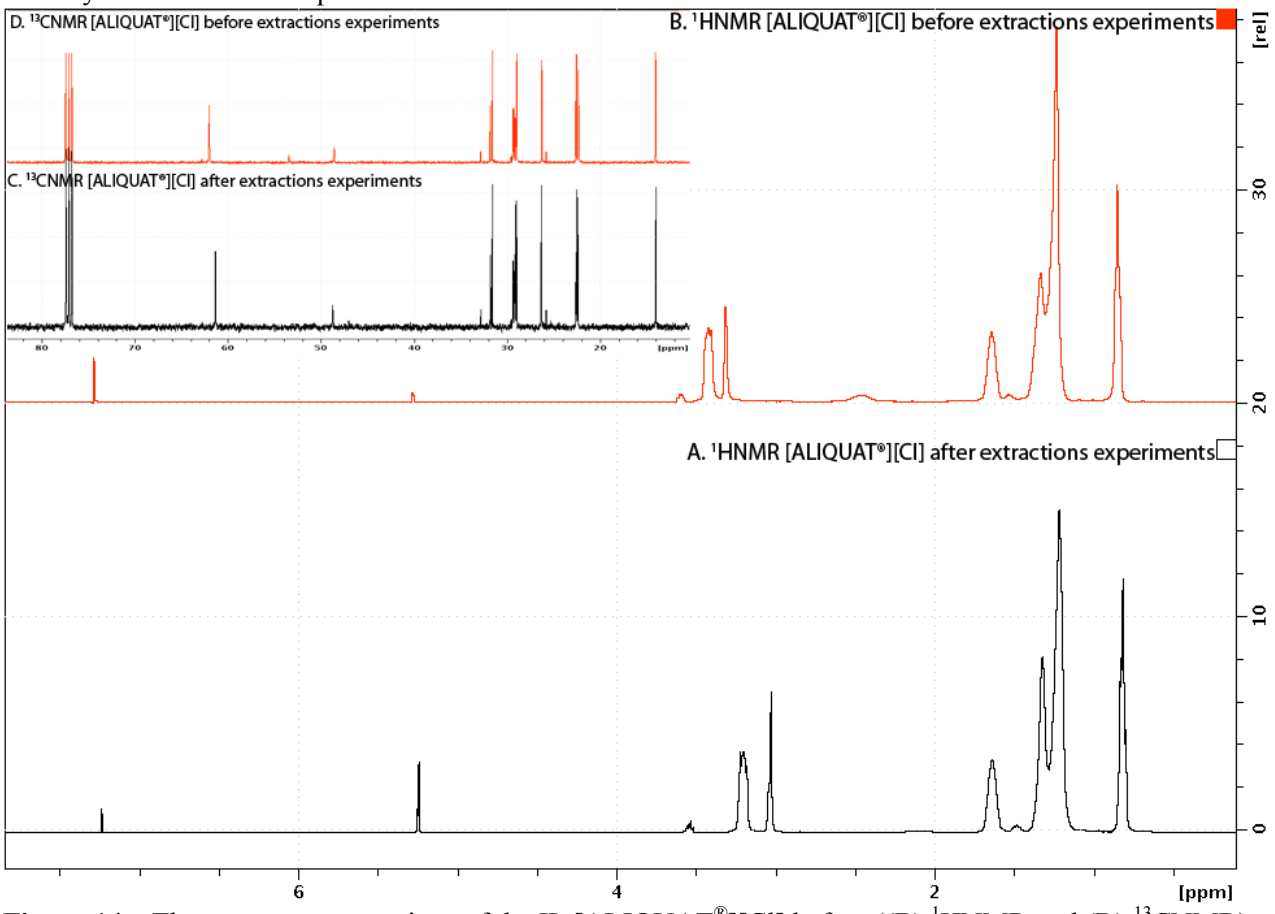

Figure 14 – The spectrum comparison of the IL [ALIQUAT®][Cl] before ((**B**) ^{1}HNMR and (**D**) ^{13}CNMR) and after ((**A**) ^{1}HNMR and (**C**) ^{13}CNMR) the extraction studies confirm the complete extraction of the carbohydrates from the IL phase.

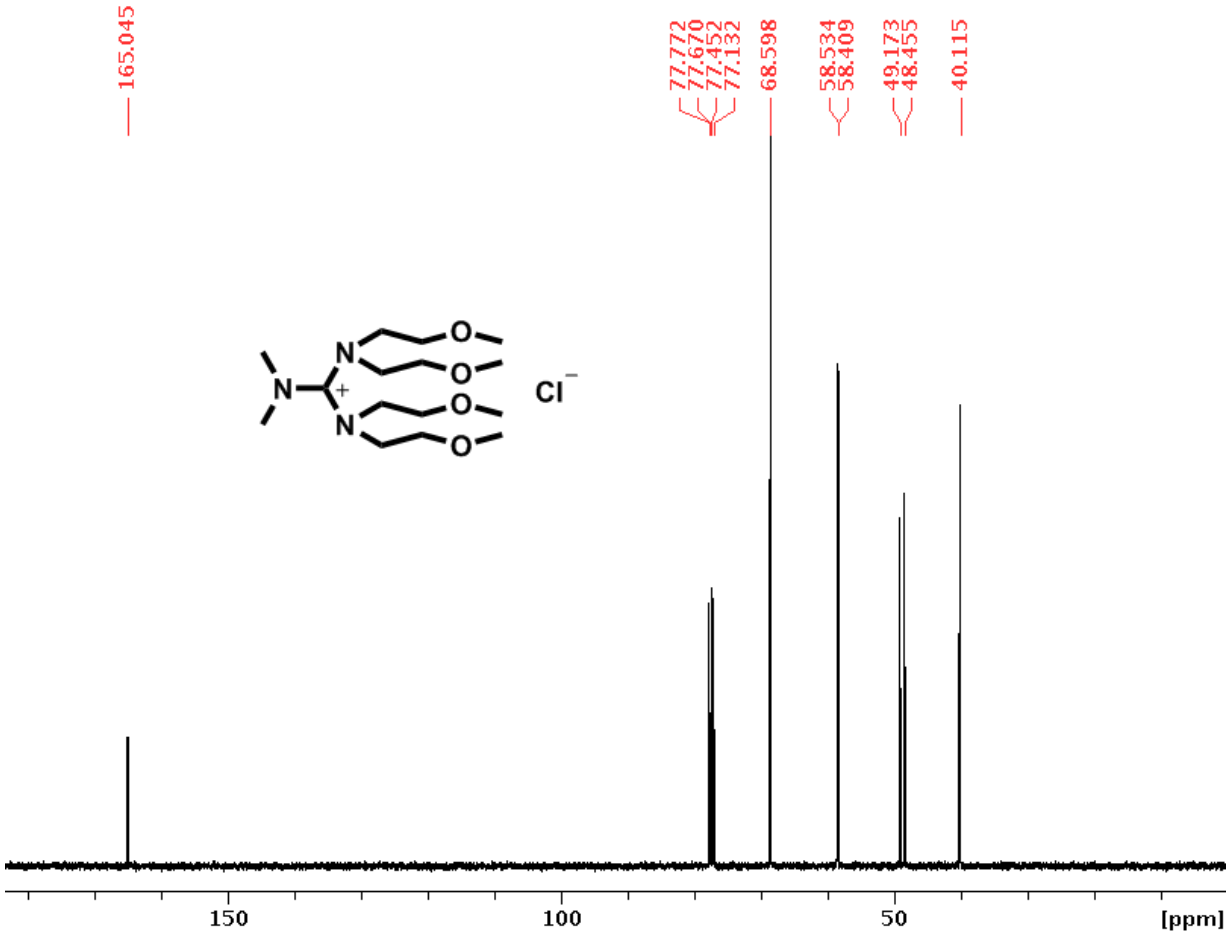

Figure 15 – $[(C_3O)_4DMG][Cl]$ ^{13}C-NMR (400MHz, CDCl3).

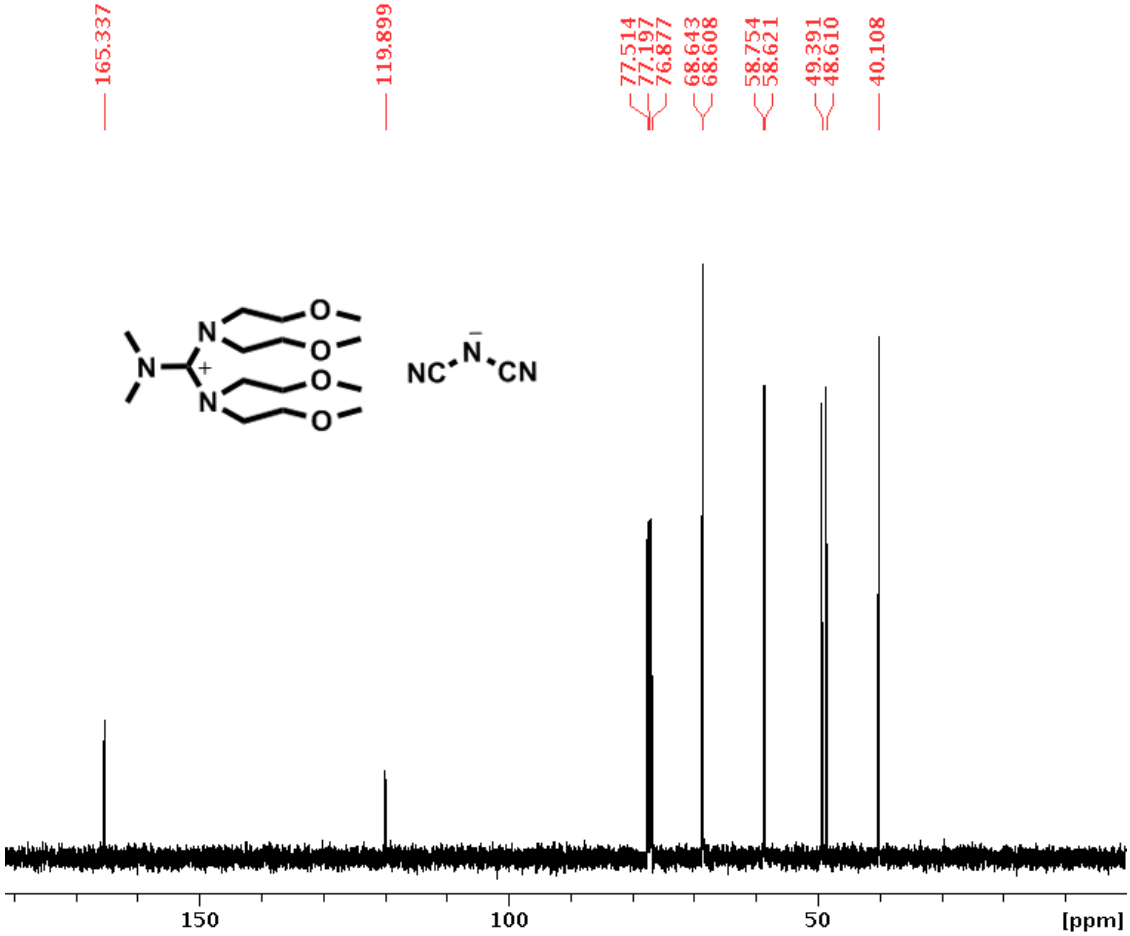

Figure 16 – $[(C_3O)_4DMG][DCA]$ ^{13}C-NMR (400MHz, CDCl3).

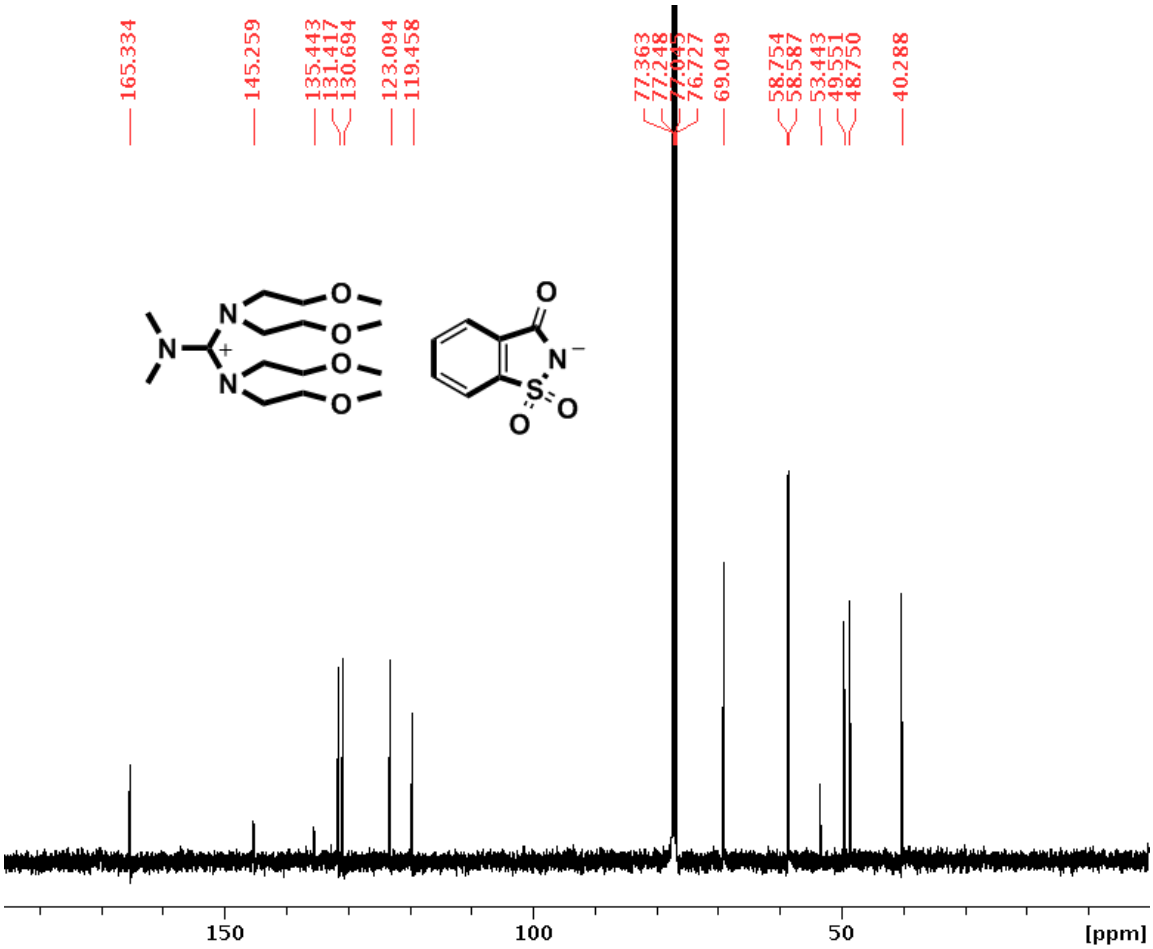

Figure 17 – $[(C_3O)_4DMG][SAC]$ ^{13}C-NMR (400MHz, CDCl3).

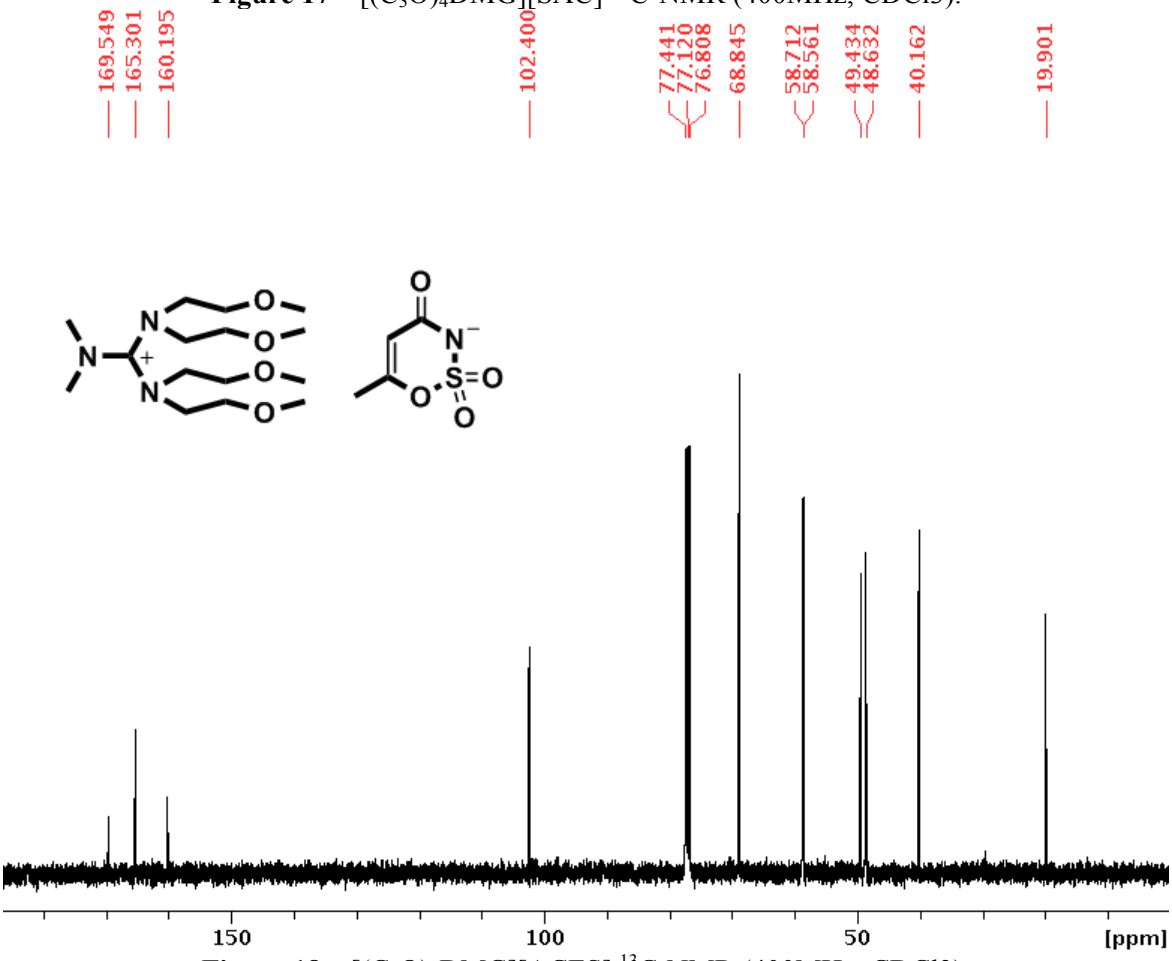

Figure 18 – $[(C_3O)_4DMG][ACES]$ ^{13}C-NMR (400MHz, CDCl3).

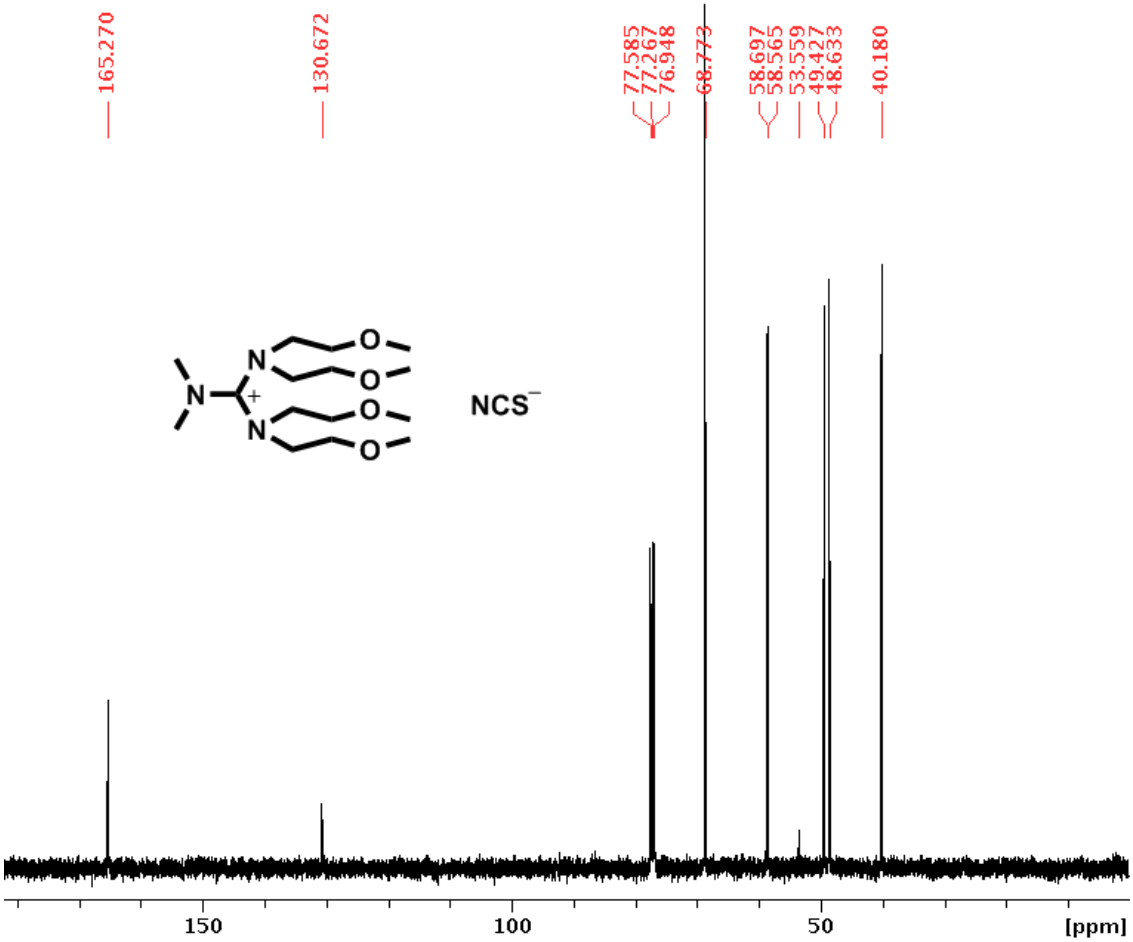

Figure 19 – $[(C_3O)_4DMG][SCN]$ ^{13}C-NMR (400MHz, CDCl3).

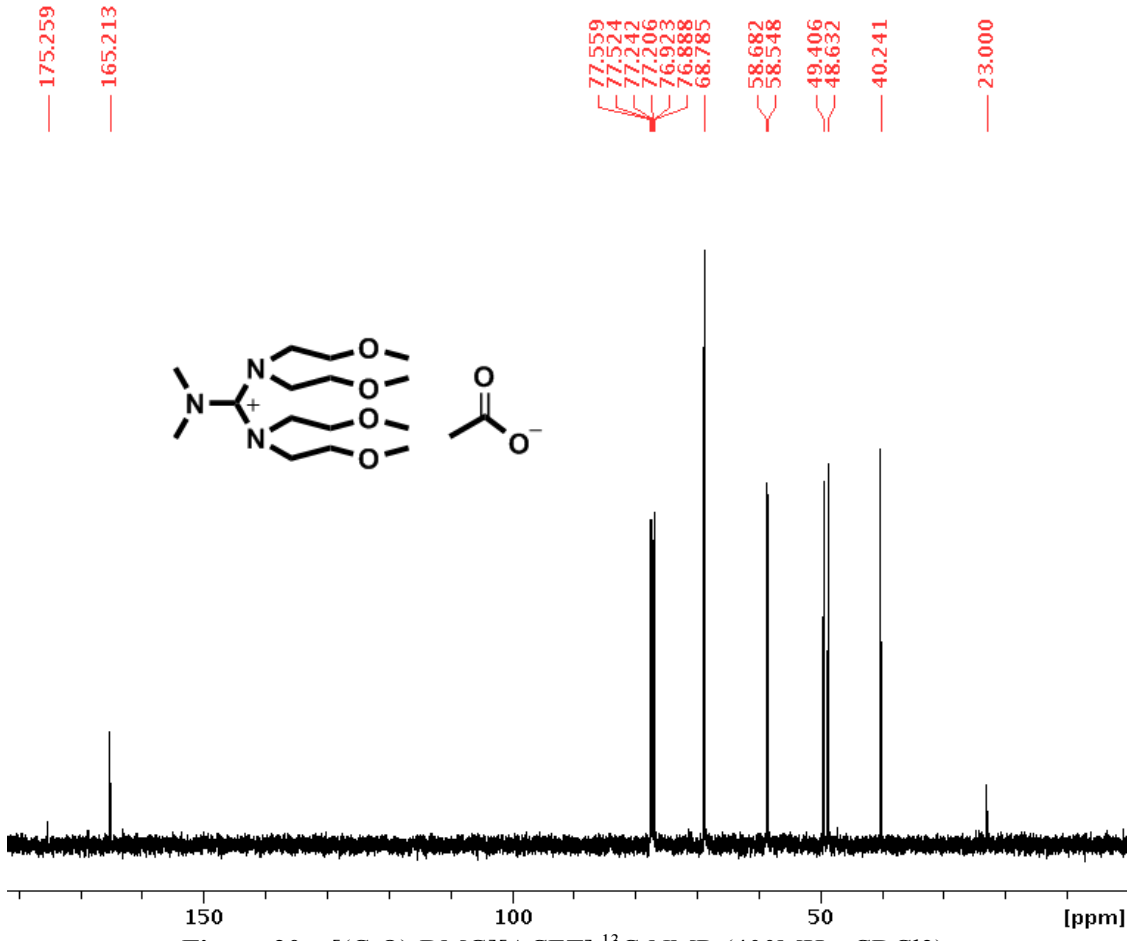

Figure 20 – $[(C_3O)_4DMG][ACET]$ ^{13}C-NMR (400MHz, CDCl3).

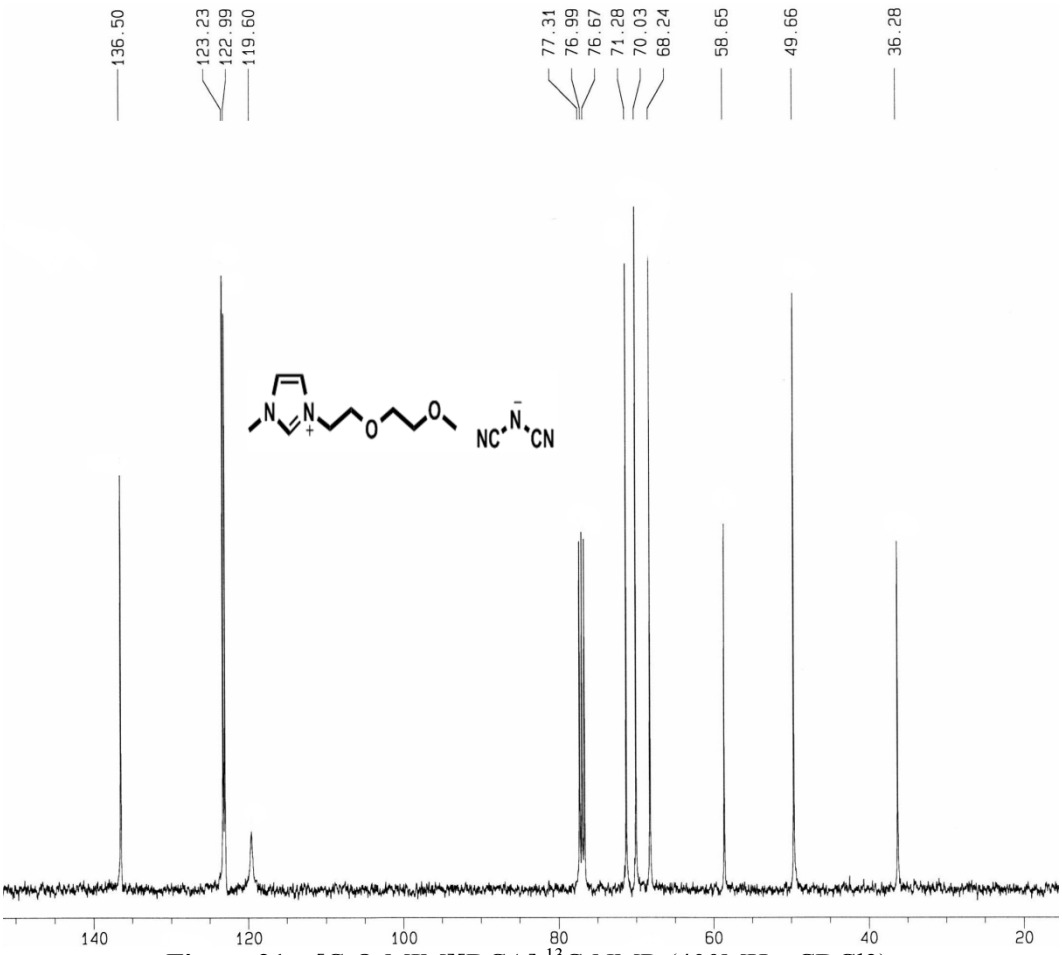

Figure 21 – $[C_5O_2MIM][DCA]$ ^{13}C-NMR (400MHz, CDCl3).

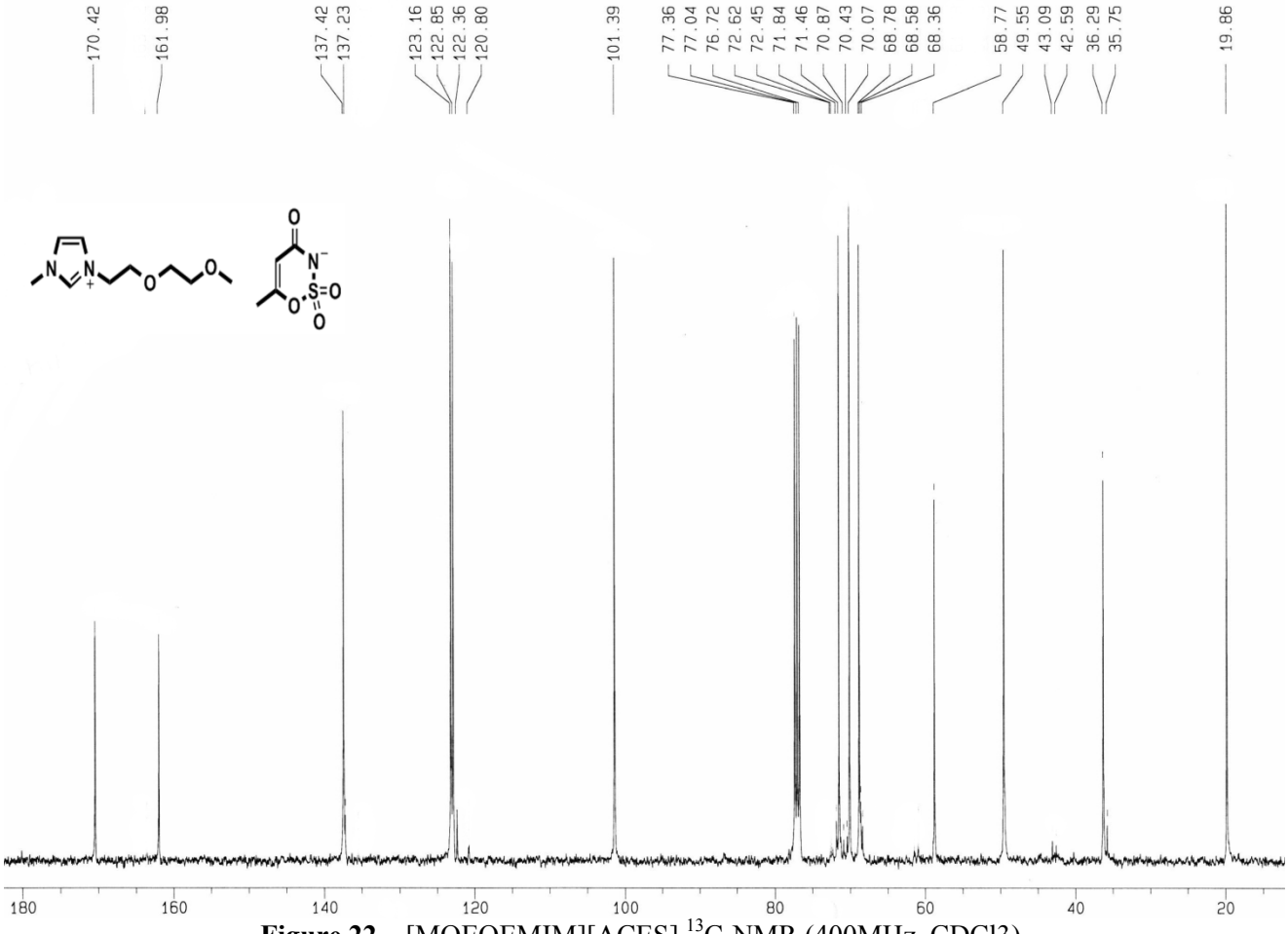

Figure 22 – [MOEOEMIM][ACES] ^{13}C-NMR (400MHz, CDCl3).

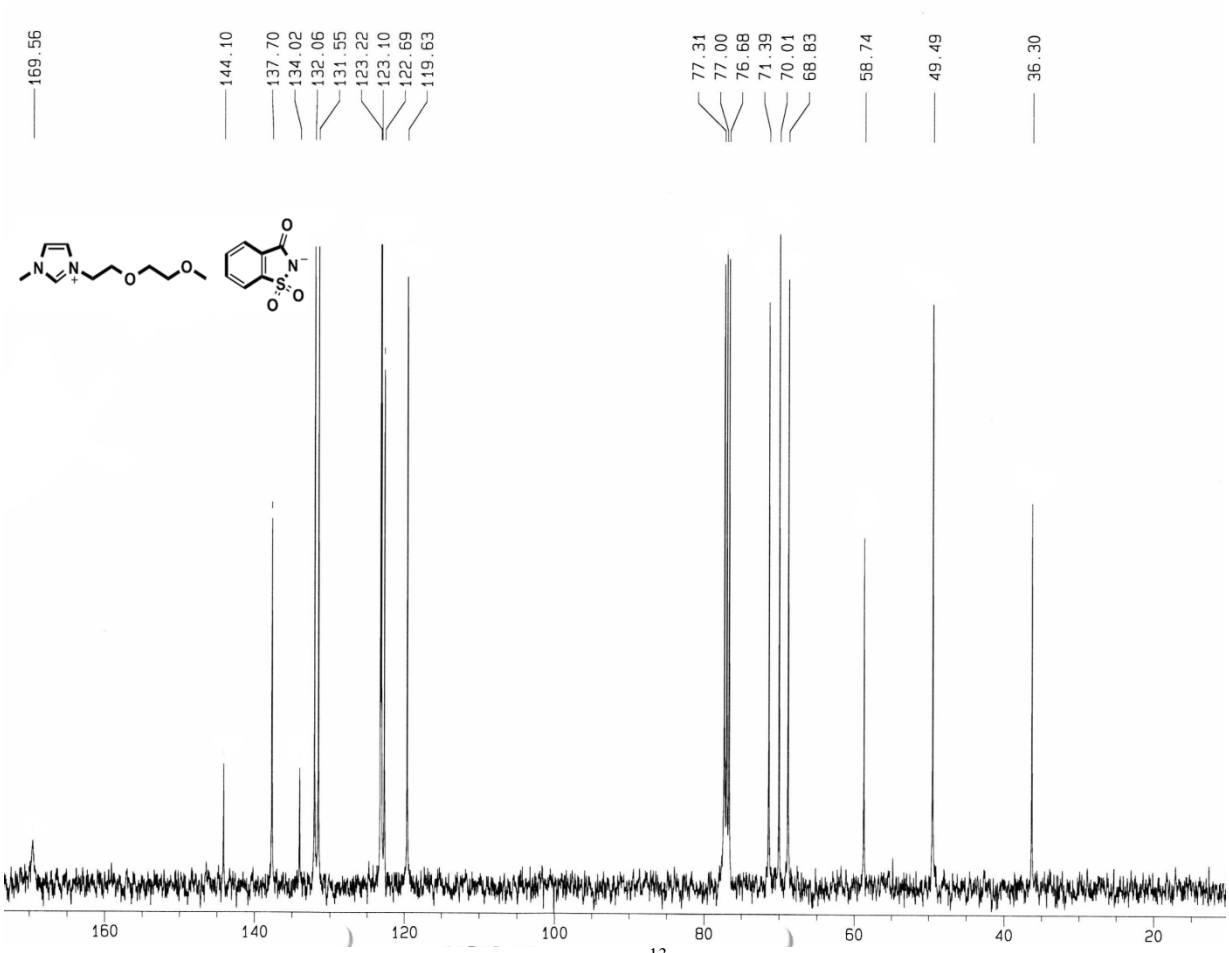

Figure 23 – [MOEOEMIM][SAC] ^{13}C-NMR (400MHz, CDCl3).

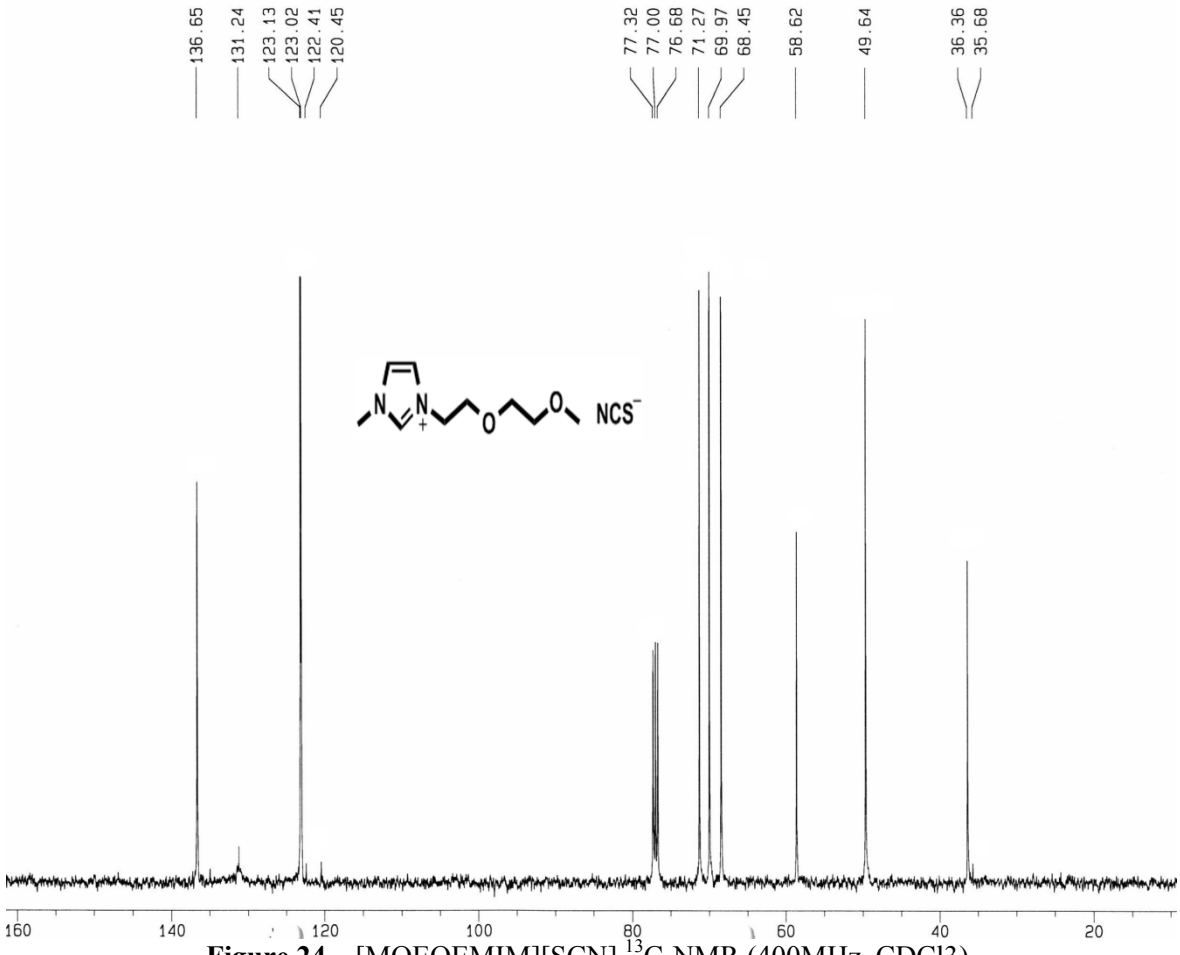

Figure 24 – [MOEOEMIM][SCN] ^{13}C-NMR (400MHz, CDCl3).

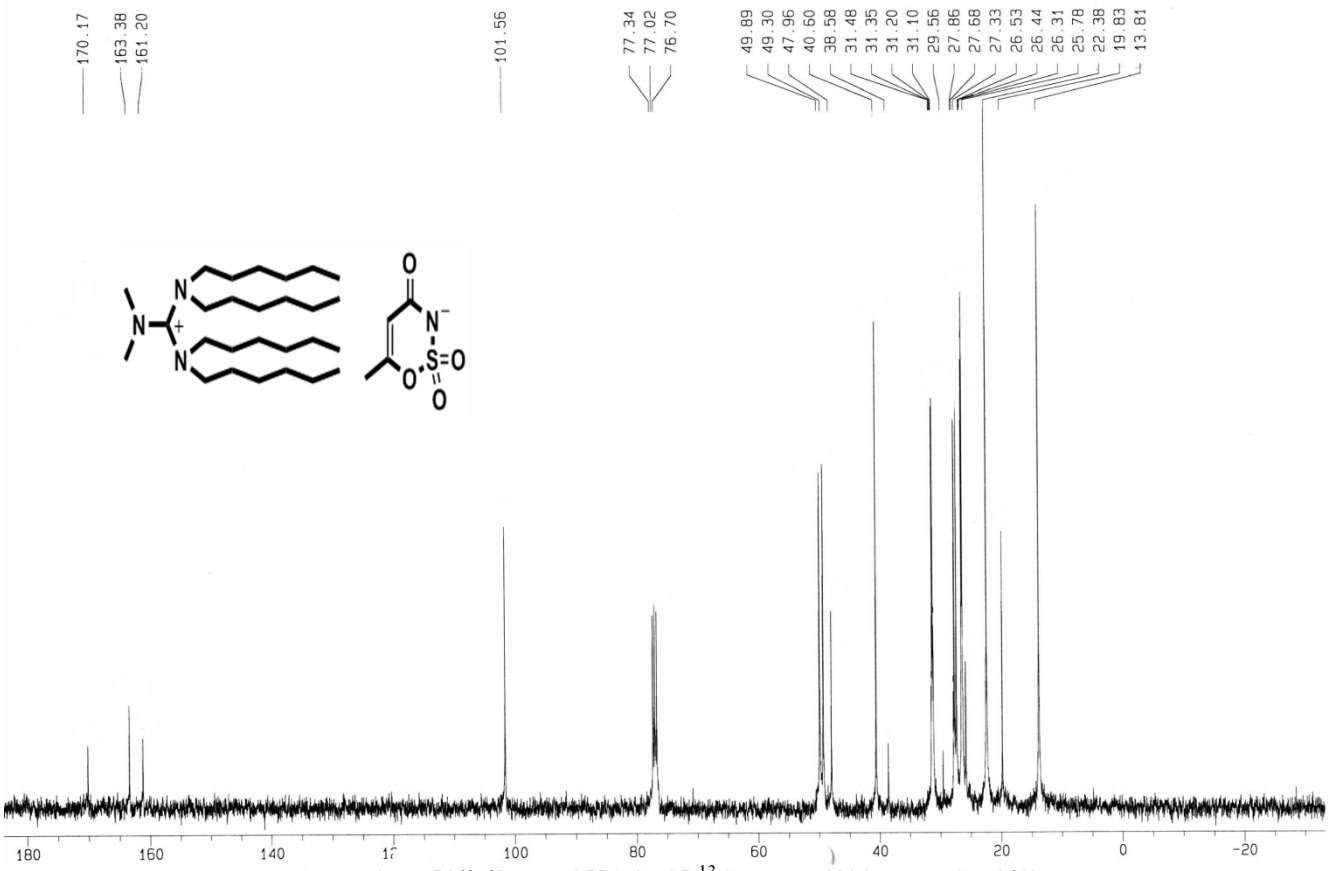

Figure 25 – [(di-*h*)$_2$DMG][ACES] ^{13}C-NMR (400MHz, CDCl3).

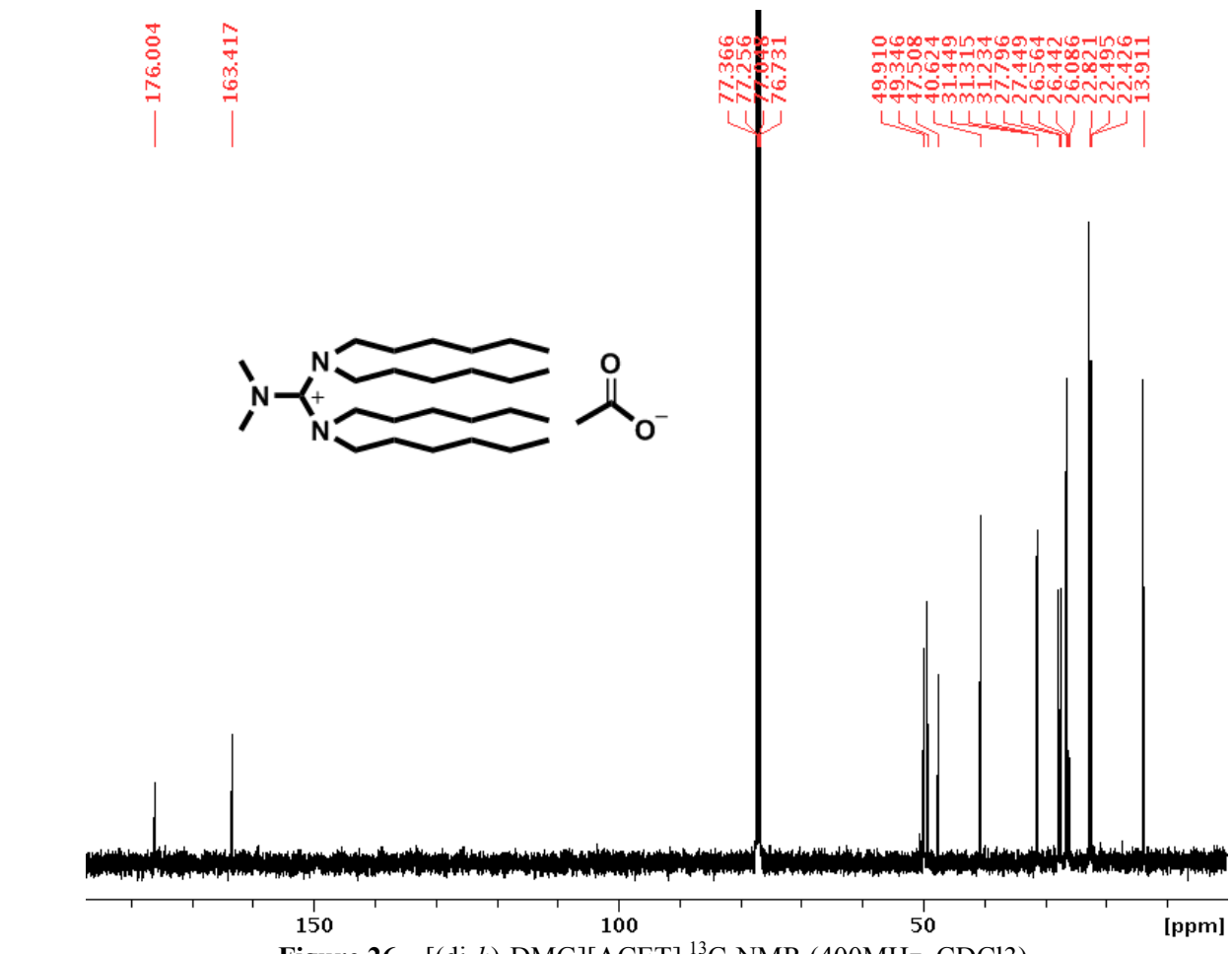

Figure 26 – [(di-*h*)$_2$DMG][ACET] ^{13}C-NMR (400MHz, CDCl3).

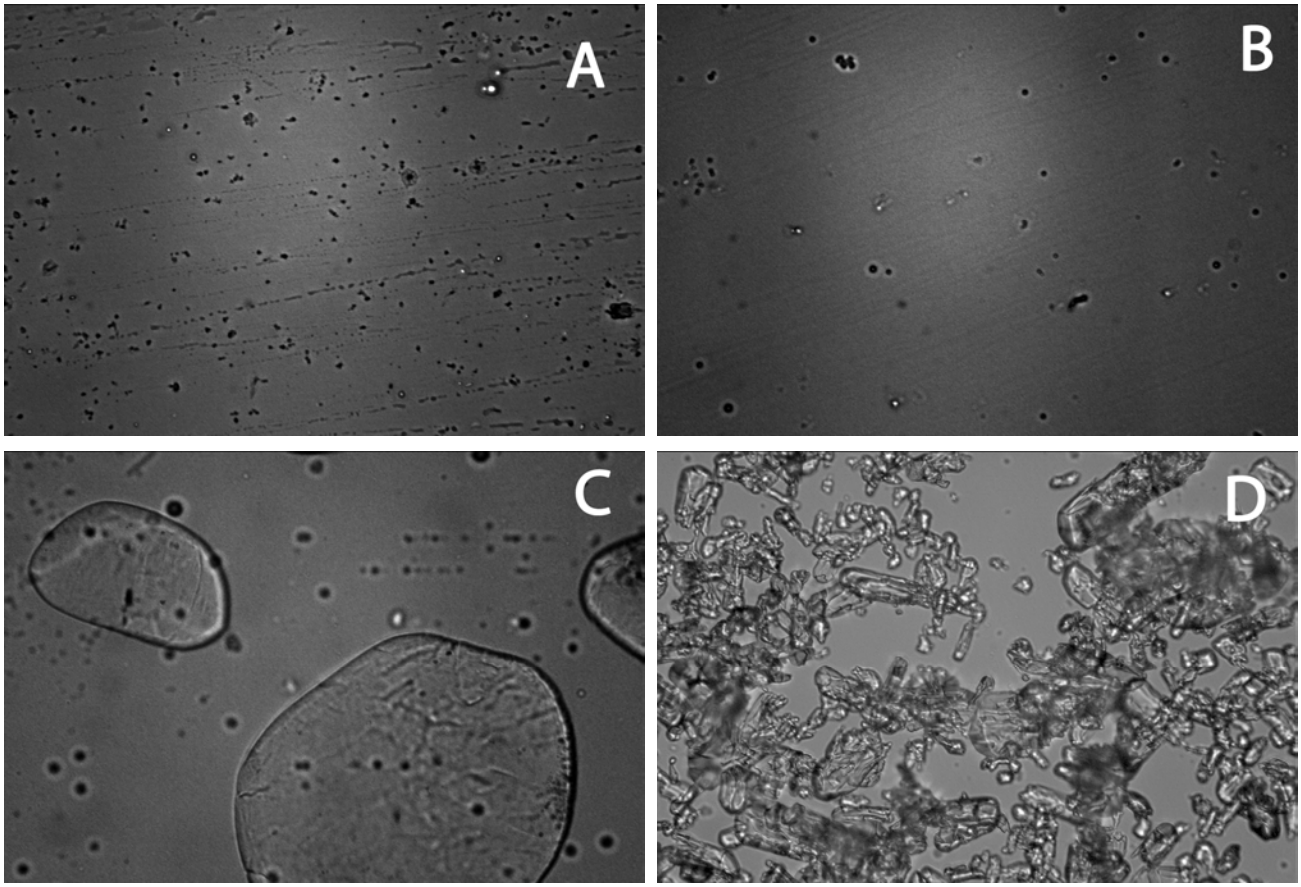

Figure 27 – Optical microscopic image (200x magnification) of: **A** – [MOEOEMIM][Cl] without glucose dissolved (dots are air bubbles and layer imperfections); **B** – [MOEOEMIM][Cl] with glucose dissolved without saturation; **C** – [MOEOEMIM][Cl] saturated with glucose; **D** – Water saturated with glucose. From the comparison of images A and B there is no difference in the IL with (B) or without (A) glucose dissolved; images C and D show glucose crystals when saturated in IL (C) or in water (D).

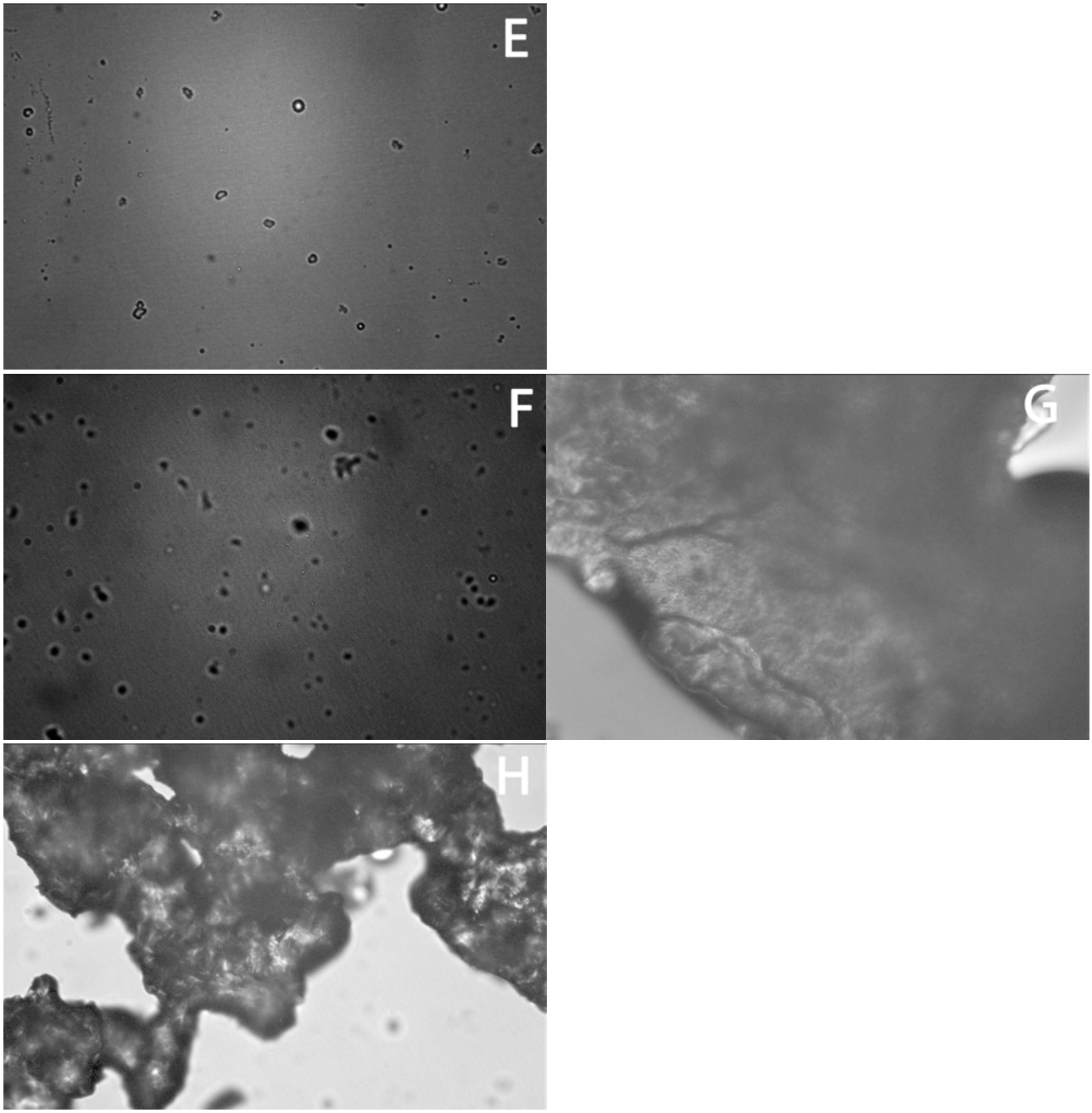

Figure 28 – Optical microscopic image (200x magnification): **E** – [$P_{6,6,6,14}$] [DCA] before extraction experiments (dots are air bubbles in the layer); **F** – [$P_{6,6,6,14}$] [DCA] after extraction experiments (with glucose dissolved); **G** – Glucose precipitated from the [$P_{6,6,6,14}$] [DCA] with dichloromethane (not crystalline); **H** – Glucose in dichloromethane (not crystalline). From the comparison of images E and F there is no difference in the IL with (F) or without (E) glucose dissolved; image G show that glucose after precipitation from the IL, with dichloromethane, is not crystalline; in image H is possible to see that glucose in dichloromethane is amorphous.