

Comparison between FLARE C18 Mixed-Mode and FLARE C18+

FLARE columns are comprised of solid-carbon cores that are coated with nanodiamonds and an amine-containing polymer. After the coating process, the particles are functionalized with C18 moieties which adds hydrophobic characteristics to the material. This process produces thermally, mechanically, and pH stable chromatographic phases that are selective for a wide host of analytes. The FLARE C18 Mixed-Mode (MM) material contains amines which can be either positively charged or neutral depending on the pH of the mobile phase. FLARE C18+ is similar to FLARE C18 MM other than it undergoes an additional functionalization process to quaternize all of the amines—resulting in a permanently positive charged surface with hydrophobic C18 ligands. To compare the differences between these two phases, a simple hydrophobic study was undertaken. The target analytes were ethyl-, butyl-, hexylbenzene and phenyloctane. The mobile phase was a mixture of phosphate buffer and acetonitrile (see Experimental). The degree of hydrophobicity of each phase was determined by plotting the log of the retention factor of each alkylbenzene vs the number of corresponding methylene units (see Figure 1). The plot was fitted to the following equation:

$$\log k = \alpha(\text{CH}_2)C_n + \beta(\text{Ph})$$

Where $\alpha(\text{CH}_2)$ and $\beta(\text{Ph})$ are the retention increments for the methylene and phenyl groups, respectively, and the C_n term is the number of methylene units in the alkyl chain.¹ Accordingly, the $\alpha(\text{CH}_2)$ value for FLARE C18 MM was 0.227 and 0.238 for FLARE C18 +; the $\beta(\text{Ph})$ values for FLARE C18 MM and FLARE C18+ were -0.497 and -0.731, respectively. As seen in the corresponding chromatograms (Figure 2) FLARE C18+ shows a reduction in retention of all alkylbenzenes, albeit the $\alpha(\text{CH}_2)$ term is greater. This reduction in retention can be attributed to the larger negative value of the $\beta(\text{Ph})$ term.

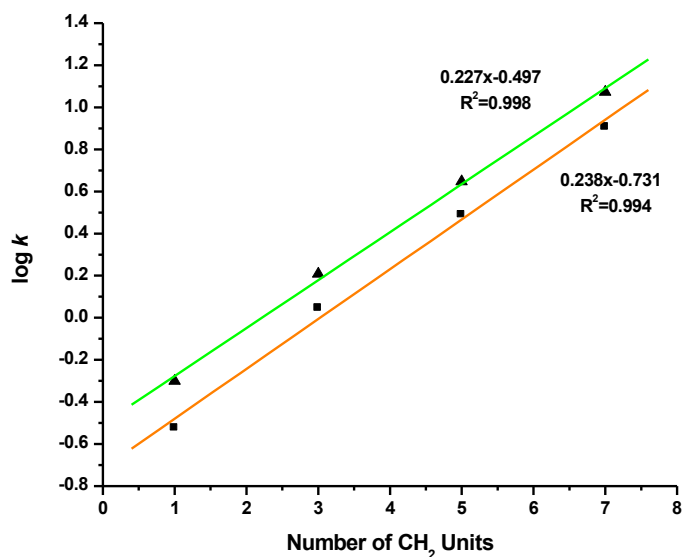


Figure 1: Retention factor vs number of methylene units of corresponding alkylbenzene. FLARE C18 MM (▲) FLARE C18+ (■)

Flow rate: 1.0 mL/min

Temperature: 35 °C

Mobile phases: 10 mM phosphate
(pH 7.0)/Acetonitrile, 50:50

References

1. L. A. Wiest, D. S. Jensen, C.-H. Hung, R. E. Olsen, R. C. Davis, M. A. Vail, A. E. Dadson, P. N. Nesterenko and M. R. Linford, *Analytical Chemistry* **83** (14), 5488-5501 (2011).

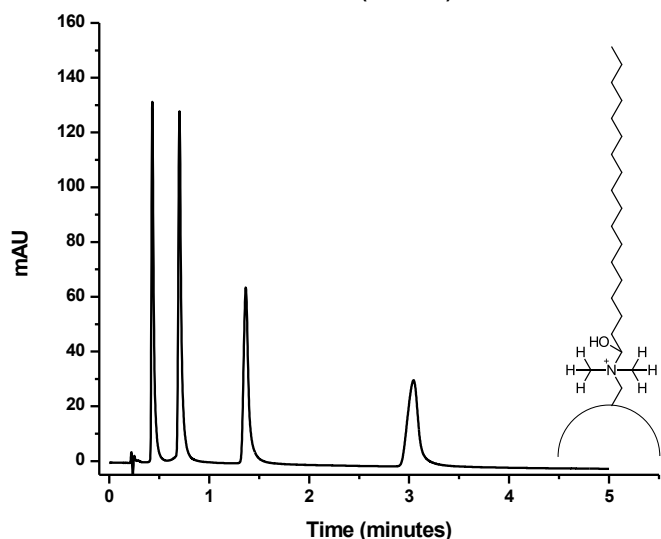
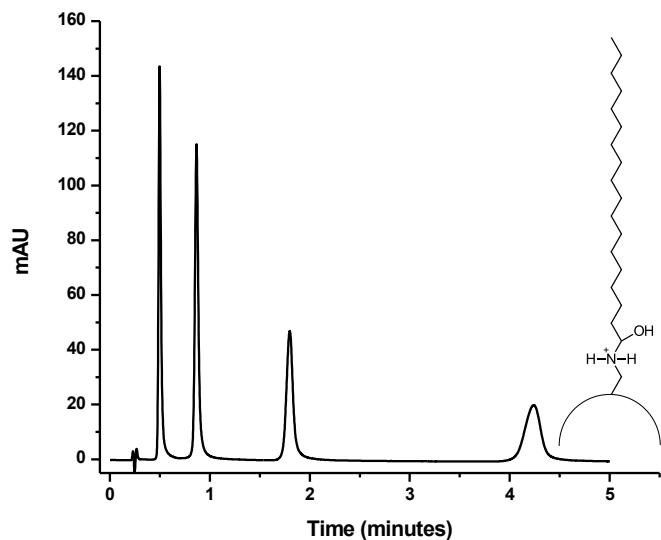


Figure 2: Chromatograms of alkylbenzenes on both FLARE C18 MM and FLARE C18+.

Experimental

Analytes: Alkylbenzene mixture (ethyl-, butyl-, hexylbenzene and phenyloctane)

HPLC system: Agilent Infinity 1290

Columns: Diamond Analytics FLARE C18 MM (4.6 x 33 mm, 3.6 μ m) and FLARE C18+ (4.6 x 33 mm, 3.6 μ m)

Injection volume: 1.0 μ L

Elution conditions: Isocratic

Detection: UV at 254 nm