

# Crown ether-type organic composite adsorbents embedded in high-porous silica beads for simultaneous recovery of lithium and uranium in seawater

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2 Table 1. The thermodynamic parameters between Li and U ions and BC15 and  
 3 BC18 adsorbents in seawater in the temperature range of 278 - 333 K.

System	Parameter 1	Parameter 2
Li / BC15 (Left: 278 - 298 K) (Right: 308 - 333 K)	$\Delta H = - 35 \pm 7$ (kJ/mol)	$\Delta H = 25 \pm 5$ (kJ/mol)
	$\Delta S = - 95 \pm 22$ (J/mol·K)	$\Delta S = 95 \pm 16$ (J/mol·K)
	$\Delta G$ (at 298 K) = $- 6.6 \pm 0.1$ (kJ/mol)	$\Delta G$ (at 308 K) = $- 4.1 \pm 0.2$ (kJ/mol)
Li / BC18 (Left: 278 - 298 K) (Right: 308 - 333 K)	$\Delta H = - 22 \pm 3$ (kJ/mol)	$\Delta H = 9 \pm 2$ (kJ/mol)
	$\Delta S = - 50 \pm 9$ (J/mol·K)	$\Delta S = 47 \pm 6$ (J/mol·K)
	$\Delta G$ (at 298 K) = $- 7.3 \pm 0.0$ (kJ/mol)	$\Delta G$ (at 308 K) = $- 5.3 \pm 0.1$ (kJ/mol)
U / BC15 (278 - 333 K)	$\Delta H = - 5.5 \pm 2.9$ (kJ/mol)	-
	$\Delta S = 61 \pm 10$ (J/mol·K)	
	$\Delta G$ (at 298 K) = $- 23.8 \pm 0.0$ (kJ/mol)	
U / BC18 (278 - 333 K)	$\Delta H = - 3.6 \pm 2.8$ (kJ/mol)	-
	$\Delta S = 70 \pm 9$ (J/mol·K)	
	$\Delta G$ (at 298 K) = $- 24.5 \pm 0.0$ (kJ/mol)	

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2 Table 2. Maximum adsorption capacities of Li and U ions using BC15 and BC18  
 3 adsorbents in seawater.

Element	Adsorbent	g / kg	mol / g	[ref.]*
Li	$\lambda$ -MnO <sub>2</sub>	0.53	$7.6 \times 10^{-5}$	[5]
	H <sub>1.6</sub> Mn <sub>1.6</sub> O <sub>4</sub>	40	$5.8 \times 10^{-3}$	[40]
	BC15	6.5	$9.3 \times 10^{-4}$	This work
	BC18	12	$1.8 \times 10^{-3}$	This work
U	IAs	0.007	$2.9 \times 10^{-8}$	[18]
	PAs	28.1	$1.2 \times 10^{-4}$	[19]
	RIGPAs	5	$2.1 \times 10^{-5}$	[20,21]
	ATRPAs	5.2	$2.2 \times 10^{-5}$	[22]
	NCs	3.4	$1.4 \times 10^{-5}$	[23]
	MOFs	-	-	-
	MSAs	0.1	$4.2 \times 10^{-7}$	[25]
	HAGEPs	0.0092	$3.9 \times 10^{-8}$	[26]
	BC15	11	$4.8 \times 10^{-5}$	This work
	BC18	4.2	$1.8 \times 10^{-5}$	This work

4 \*The references with the largest maximum adsorption capacities among  
 5 individual adsorbents were chosen.