Answer on - Chemistry - Physical Chemistry

Question:

13. The stability constant of the complex of {2-[5-(3-Chloro-4-methyl-phenylamino)-1,2,4-thiadiazole-3-yl]-1-methyl-ethyl}-(2,2,6,6-tetramethyl-piperidine-4-yl)-amine with β-cyclodextrin (β -CD) is β=540 M-1. Estimate the concentration of free substance X if its initial concentration is 0.01 M and CM-β -CD concentration is 0.2 M.

Solution:

	X + CM-β –CD	=	X- CM-β –CD
C_0	0.01	0.2	0
ΔC	-x	-x	x
[C]	0.01-x	0.2-x	x

β = [X- CM-β –CD]/([X][CM-β –CD]);

540 = x / ((0.01-x) (0.2-x);

540 = x / (0.002-0.21x+x^2);

x=540x^2-113.4x+1.08;

540x^2-114.4x+1.08=0

x = 0.00991

So, (-x) of x = -0.0099 M;

So, [X] = 0.01-0.0099 = 0.0001 M.

Answer: 0.0001 M.