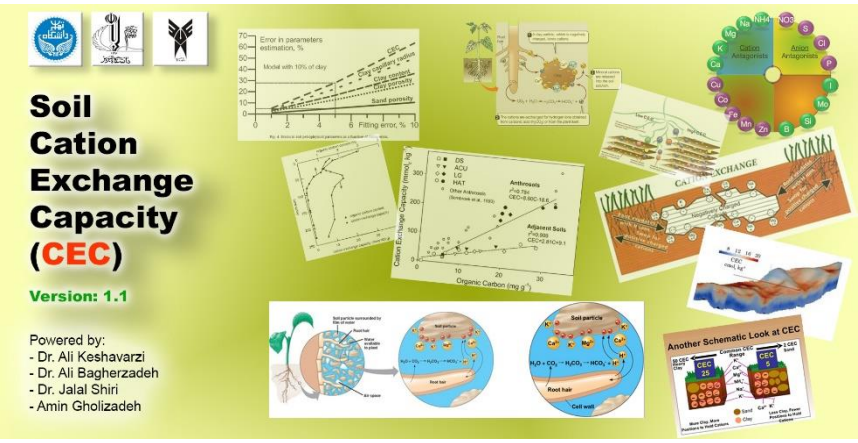
Soil Cation Exchange Capacity Estimator (CEC-App)



Description

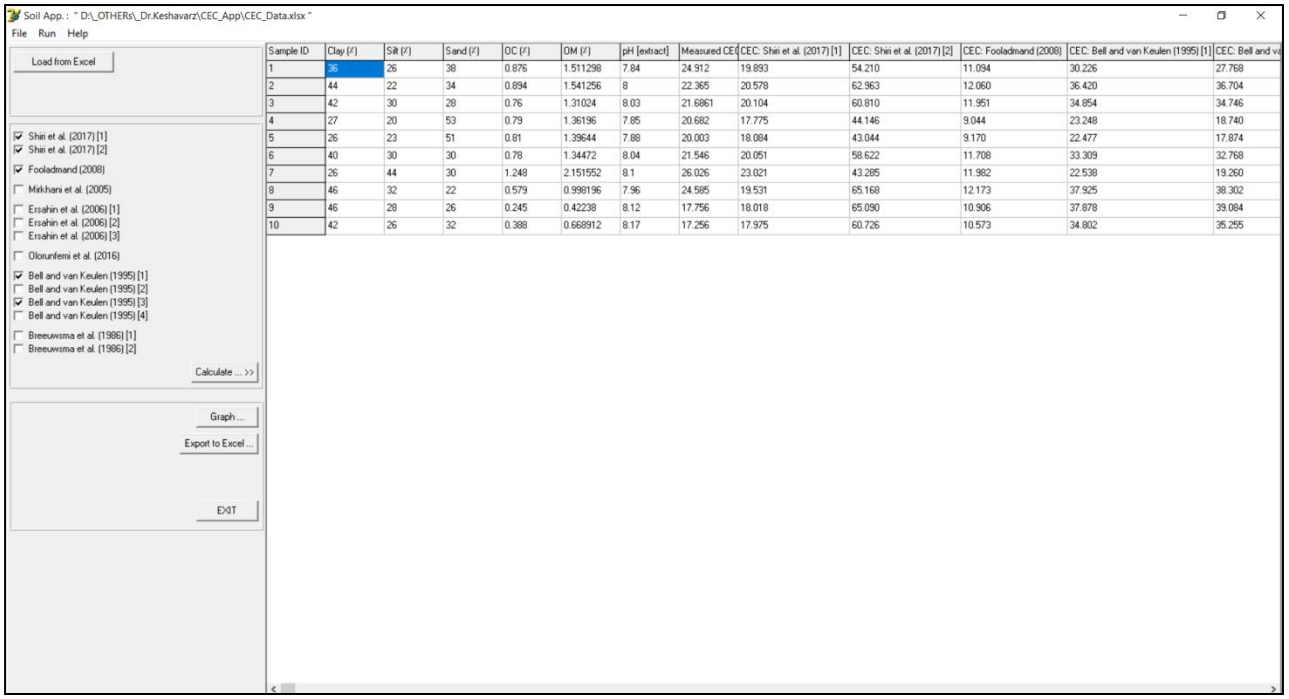
The algorithms of software for estimating the CEC is based on the equations shown below. the program has been written in Delphi Programming language. The parameters are given in an Ms-Excel format file to CEC-App. The result can also be demonstrated in Ms-Excel format. The software has the ability to demonstrate regression equation between the influencing factors and the CEC derived by each equation. The software has been designed quite user friendly and conducts the user correctly through the calculations step by step and don't allow the user to make a mistake. It is compatible with 32 and 64-bit windows operating system types.

The table of equations and screenshots of the software calculations has been shown below:

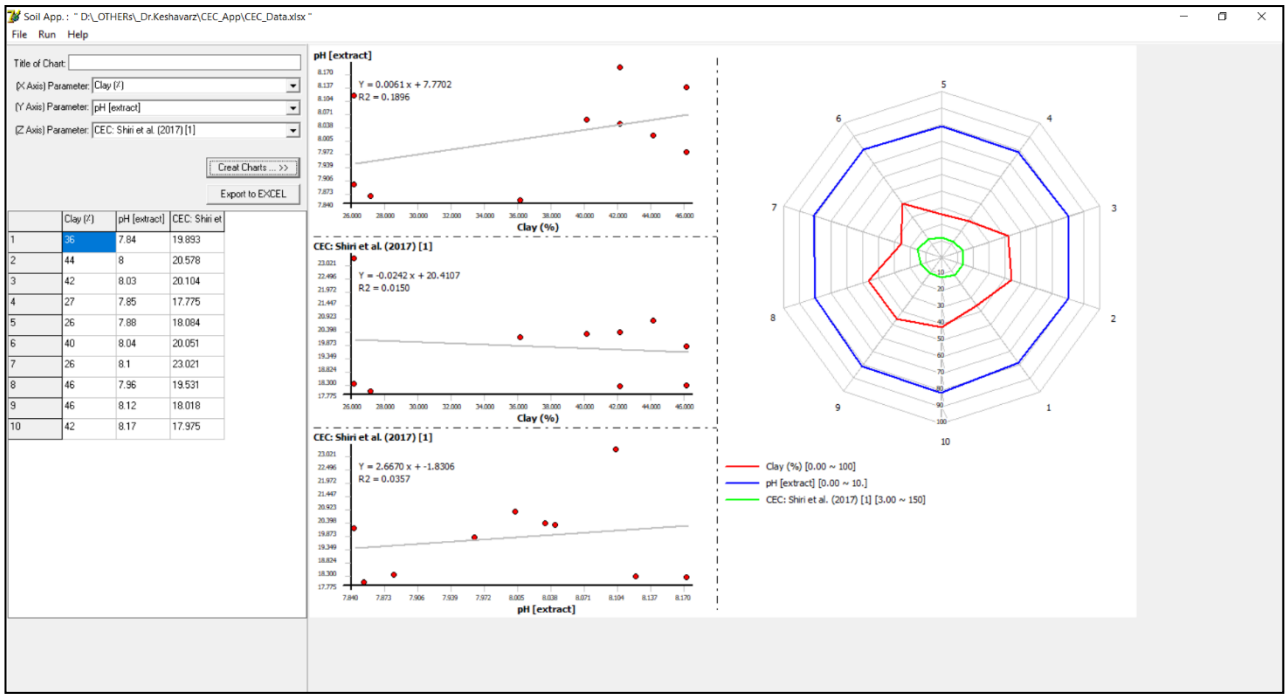
Input Parameters	Output
OC (%)	CEC (cmolc/kg)
OM (%)	
Clay (%)	
Silt (%)	
Sand (%)	
pH (in water)	

References	Equations
Shiri et al. (2017)	$CEC = \sqrt{Clay + Silt - OC^3} + 1.58532 Clay.OC^2 + Ln\left[pH^2 (Silt - OC)\right] + 0.821\sqrt[3]{pH} + \left[\left(\frac{OC + pH}{Silt - 2.5726}\right)^6 + OC\right]^3$
Shiri et al. (2017)	$CEC = \log\left[2Clay - 13.969\right] + \sqrt{Clay - \sqrt{sand} + 2OC + 6.192} + Clay + 10.30$
Fooladmand (2008)	CEC = 8.501+ (0.078 * Clay) – (0.073 * Sand) + (1.693 * OM)
Mirkhani et al. (2005)	CEC = (-0.01) + ((0.233)*(Clay)) + ((0.00187)*(Silt)^2)) + ((7.69)*(OC)$^{0.5}$))
Ersahin et al. (2006)	CEC = 4.97 + (0.53 * Clay)
Ersahin et al. (2006)	CEC = 36.47 - (0.44 * Sand)
Ersahin et al. (2006)	CEC = 54.62 - (0.76 * Silt)
Olorunfemi et al. (2016)	CEC = (-13.93) + (2.645 * pH) + (0.0446 * Clay) + (2.267 * OM)
Bell and van Keulen (1995)	CEC = (2.24) + (0.774 * Clay) + (0.0807 * OM)
Bell and van Keulen (1995)	CEC = (5.79) + (0.100 * Clay * pH)

Bell and van Keulen (1995)	CEC = (- 10.0) + (0.163 * OM * pH) – (0.0209 * OM * Clay) + (0.131 *Clay *pH)
Bell and van Keulen (1995)	CEC = (42.8) – (5.36 *pH) + (0.297* OM) – (2.04 *Clay) + (0.363* Clay* pH)
Breeuwsma et al. (1986)	CEC = (2.5 * OM) + (0.5 * Clay)
Breeuwsma et al. (1986)	CEC = (1.5 * OM) + (0.5 * Clay)



Sample ID	Clay (%)	Silt (%)	Sand (%)	OC (%)	OM (%)	pH [extract]	Measured CEC	CEC: Shiri et al. (2017) [1]	CEC: Shiri et al. (2017) [2]	CEC: Fooladmand (2008)	CEC: Bell and van Keulen (1995) [1]	CEC: Bell and v
1	36	26	38	0.876	1.511298	7.84	24.912	19.893	54.210	11.094	30.226	27.768
2	44	22	34	0.894	1.541256	8	22.365	20.578	62.963	12.060	36.420	36.704
3	42	30	28	0.76	1.31024	8.03	21.6861	20.104	60.810	11.951	34.854	34.746
4	27	20	53	0.79	1.36196	7.85	20.682	17.775	44.146	9.044	23.248	18.740
5	26	23	51	0.81	1.39644	7.88	20.003	18.084	43.044	9.170	22.477	17.874
6	40	30	30	0.78	1.34472	8.04	21.546	20.051	58.622	11.708	33.309	32.768
7	26	44	30	1.248	2.151552	8.1	26.026	23.021	43.285	11.982	22.538	19.260
8	46	32	22	0.579	0.998196	7.96	24.585	19.531	65.168	12.173	37.925	38.302
9	46	28	26	0.245	0.42238	8.12	17.756	18.018	65.090	10.906	37.878	39.084
10	42	26	32	0.388	0.668912	8.17	17.256	17.975	60.726	10.573	34.802	35.255



	Clay (%)	pH [extract]	CEC: Shiri et
1	36	7.84	19.893
2	44	8	20.578
3	42	8.03	20.104
4	27	7.85	17.775
5	26	7.88	18.084
6	40	8.04	20.051
7	26	8.1	23.021
8	46	7.96	19.531
9	46	8.12	18.018
10	42	8.17	17.975

References

1 - Shiri, J., Keshavarzi, A., Kisi, O., Iturraran-Viveros, U., Bagherzadeh, A., Mousavi, R., Karimi, S. 2017. Modeling soil cation exchange capacity using soil parameters: Assessing the heuristic models. Computers and Electronics in Agriculture, 135: 242-251.

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4- Ersahin, S., Gunal, H., Kutlu, T., Yetgin, B., Coban, S. 2006. Estimating specific surface area and cation exchange capacity in soils using fractal dimension of particle-size distribution. Geoderma, 136: 588-597.

5- Olorunfemi, I., Fasinmirin, J., Ojo, A. 2016. Modeling cation exchange capacity and soil water holding capacity from basic soil properties. Eurasian Journal of Soil Science, 5(4): 255-331.

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