EC dilutions calculator

Note: To make links work, download this file and use a pdf-viewer on your PC.

Using an economic conductivity meter, there is only a limited scale: mine only reaches 999 µS/cm: it is more suitable for drinking water than for hydroponic solutions!
Patience: Conductivity measurements in excess of the range in use can be done with single or double dilutions.
To facilitate operations, making them very simple but reliable, I developed a protocol and an 'ad hoc' calculator (up to dilutions over 1:10000). The calculation is made in OpenOffice-calc, which can be used on a PC and, more useful, on a smartphone.

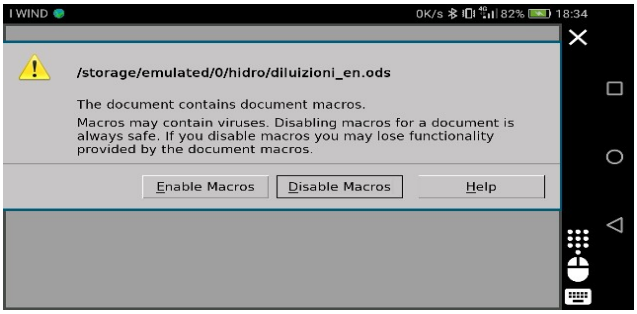
Required material:

- Conductivity meter
- Digital scale: mine has a maximum capacity of 200 g and an accuracy of ± 0.01 g (Chinese 11 €)
- 200 ml disposable plastic glasses (equal to the maximum scale capacity)
- Water for dilution, low EC (bidistilled, osmosis, oligomineral).

Sw installation

- *Windows, Linux, OS X*: download ***OpenOffice*** (free) from http://www.openoffice.org/
- *Android*: install ***AndrOpenOffice*** (free) from *GooglePlay* https://play.google.com/store/apps/details?id=com.andropenoffice&hl=it

Download the file `diluizioni_en.ods` from `https://github.com/millano/MyHydroponics/tree/master/EC_dilutions` and copy it to a known location, for example: `documents/hydroponics` for Windows or `internal memory/hydro` for Android (use a PC management software suitable for your mobile phone to copy the file).



Run *OpenOffice/AndrOpenOffice* then from menu *File/Open* load `diluizioni_en.ods`.

Associate `'.ods'` files with *OpenOffice, AndrOpenOffice* to open them automatically.

If required, enable macros

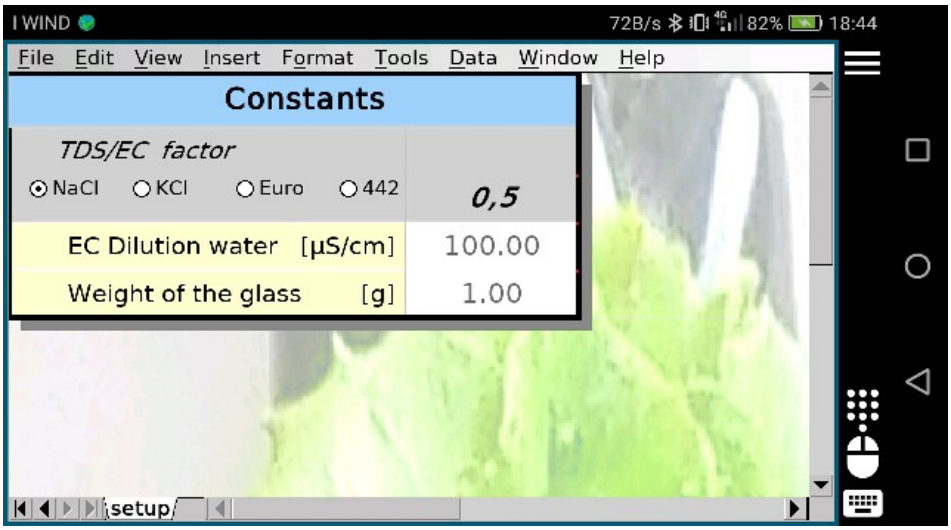
When finished, closing *OpenOffice / AndrOpenOffice*, DO NOT save the changes.

note: spreadsheet sheets are protected only to avoid accidental changes. The password, for those who want to change them is 'diluizioni'.

setup

Constant options and values to be set 'una tantum'.

TDS/EC Factor



Conventional factor, varies depending on the composition of the solution (range 0.5÷1):

NaCl, used in the USA = 0.5
KCl, also used = 0.55
Euro, used in Europe = 0.65
442 used in Australia (40% sodium sulfate, 40% sodium bicarbonate and 20% sodium chloride) = 0.7.

notes:

- '*The coefficient of 0.64 is appropriate for a fairly wide range of conditions. For mixed composition waters, consider the use of a factor of 0.735, and for solutions concentrated with EC higher than 5000 µS/cm consider the use of a factor of 0.8* '(modified from WateReuse Foundation). See also "Correlation between conductivity and total dissolved solid in various type of water: A review".
- It is possible to enter unforeseen values for *TDS/EC Factor* by writing them directly in the cell.

For solution management, use EC measures. Using TDS to compare your values with some published data, always verify that measurements are performed using the same *TDS/EC Factor.*

EC dilution water

Measured conductivity value of the water used for the dilutions:

- Bidistilled water: almost 0 µS/cm; almost 0 ppm
- Osmosis/demineralized/deionized water: 0 - 5 µS / cm; 0 - 2.5 ppm @0.5
- Rainwater: 5 - 20 µS / cm; 2.5 - 10 ppm@0.5
- Bottled water, low mineralized: 20 - 100 µS / cm; 10 - 50 ppm@0.5
- Tap water: 150 - 600 µS / cm; 75 - 300 ppm@0.5

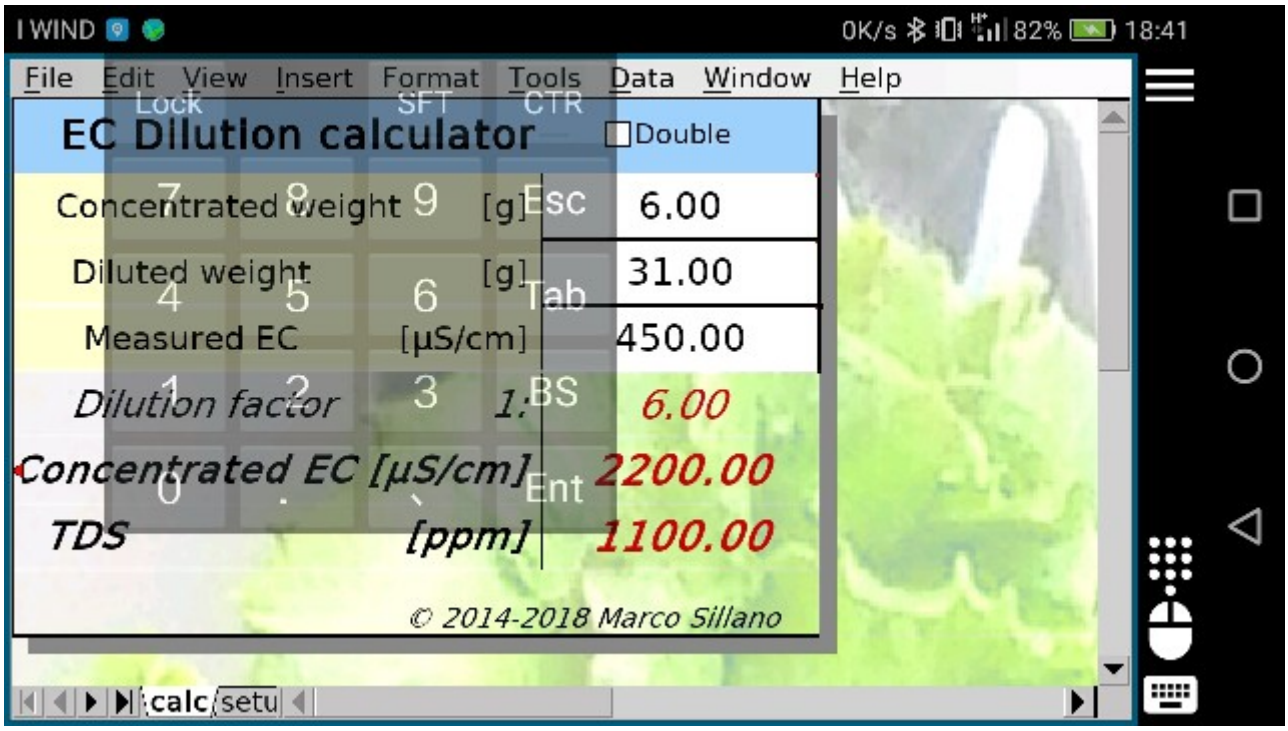
Weigh of the glass

Weigh an empty glass and insert the weight (from the example in the picture, 5.42 g).

Thus all the weights of the dilutions will be simpler, also including the tare of the glass.

single dilution

You must perform the following steps in sequence:



1. Turn on the scale, check that it shows 0.00. Place a new glass on the scale.
   Put on glass a small amount of the solution to be measured: from 2 to 50 grams.
   Enter the weight you read (tare included) in the first white cell (*Concentrated weight*).
2. Add dilution water, up to 100 - 200 g.
   Enter the weight you read (tare included) in the second white cell (*Diluted weight*).
3. Mix the solution and measure the EC of the diluted solution with the conductivity meter. It is advisable that the value read is in the upper half of the scope of the meter.
   Enter the value in the third white cell (*Measured EC*).

note: always wash the conductivity probe with dilution water after use

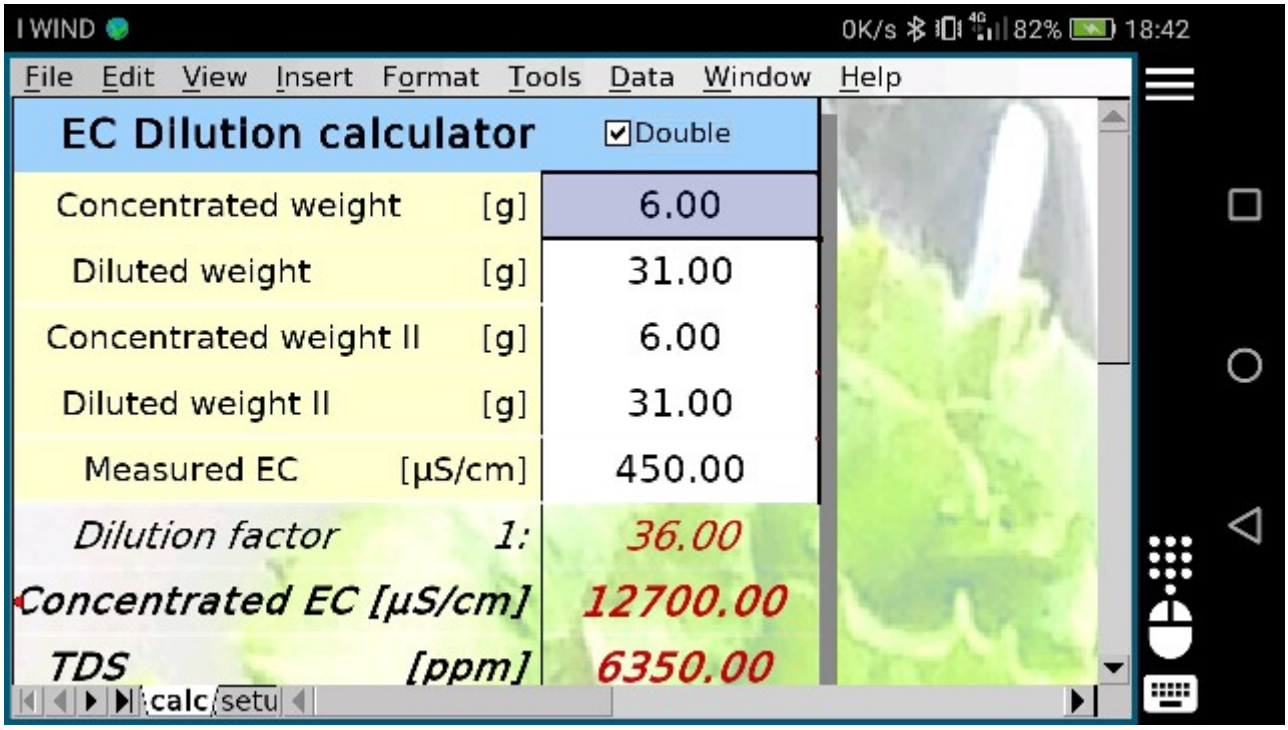
The results appear in red.

The great convenience of this protocol is that precise quantities of solution and water are not necessary: just write the exact weights in the calculator.
Furthermore the used formulas take into account the water EC used for the dilution: it is not necessary to always use bidistilled water.

note: the numeric keypad of AndrOpenOffice is very useful for entering numbers: it is activated/deactivated with the symbol with 10 white dots at the bottom right (see figure).

double dilution

If in step 3 the conductivity is still too high to be measured, do not enter any value and choose the 'double' option:



4. Throw away a large part of the diluted solution obtained in step 2, keeping only 2-50 g.
   Enter the weight read in the third white cell (*Concentrated weight II*)
5. Add dilution water, up to 100 - 200 g.
   Enter the weight you read in the fourth white cell (*Diluted weight II*).
6. Mix the solution well and measure the EC of the diluted solution. It is advisable that the value read is in the upper half of the scope of the meter.
   Enter the value in the fifth white cell (*Measured EC*).

The results appear in red.

note: If very precise values are required, repeat the measurement 3 times, using a new glass every time, and averaging the 3 results obtained.