Experimental General Physics for Engineers II

Laboratory Report PHYS 194 summer 2022

Section: __L01___

Experiment name: # Dielectric Constant

Student Name:	Talha Abdullah Punjabi	Student ID	201903446

Date submitted:	6/4/2022

Table of results (1.25 pts)	
Graph (1.25 pts)	
Data analysis (2 pts)	
Discussion (0.5 pt)	
References	
Others	
Report Grade (5 pts)	

1. Table of results (Put correct units in the table)

1.1. Results with dielectric inserted

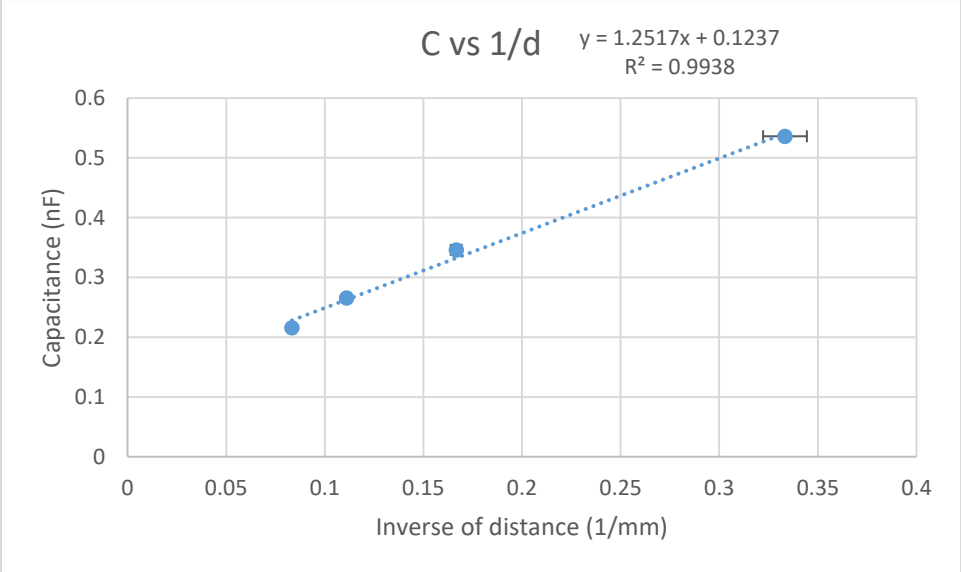
Number of sheets	Distance d (mm)	u(d) (mm)	inverse of the distance $1/d$ $(mm)^{-1}$	$u(1/d)$ $(mm)^{-1}$	Capacitance C (nF)	$u(C)$ (nF)
1	3 mm	±0.1	0.333	±0.011	0.536	±0.001
2	6 mm	±0.1	0.167	±0.003	0.346	±0.001
3	9 mm	±0.1	0.111	±0.001	0.266	±0.001
4	12 mm	±0.1	0.083	±0.0007	0.216	±0.001

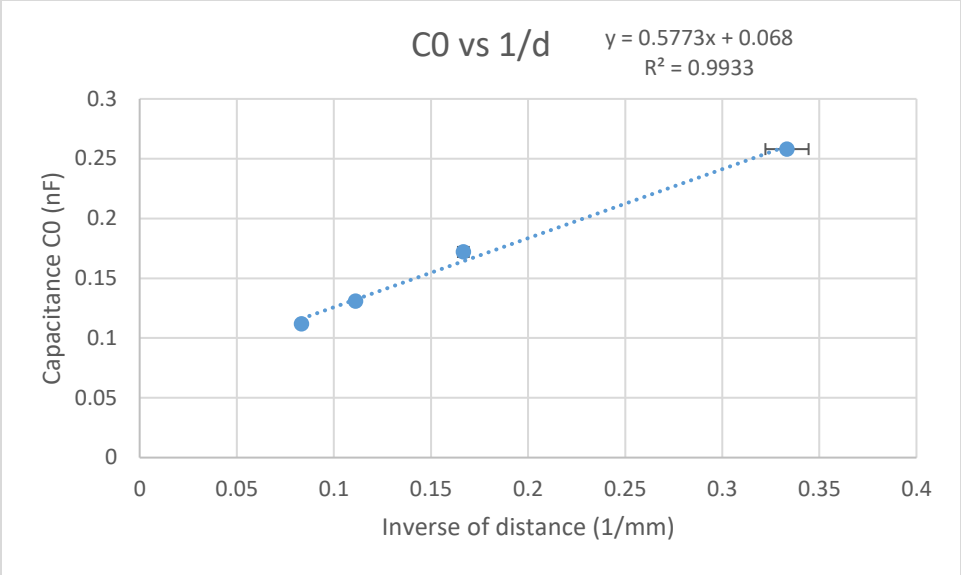
1.2. Results without dielectric inserted

Capacitance Co (nF)	$u(Co)$ (nF)
0.258	±0.001
0.172	±0.001
0.131	±0.001
0.112	±0.001

2. Graphs of Capacitance vs. inverse distance (with and without dielectric)

Insert the two graphs here





3. Data analysis

3.1. Slope of the first graph, with dielectric, and intercept and their uncertainties

Slope: 1.252 nF/mm^{-1}
Slope Intercept: ±0.069 nF /mm^{-1}
Intercept: 0.1237 nF
Intercept Error: ±0.01387 nF

3.2. Slope of the second graph, without dielectric, and intercept and their uncertainties

Slope: 0.5772 nF/mm^{-1}
Slope Intercept: ±0.03355 nF/mm^{-1}
Intercept: 0.0680 nF
Intercept Error: ±0.00667 nF

3.3. Calculation of the propagated error on $1/d$:

Show how you calculate $u(1/d)$

U(1/d) = sqrt (d (1/d) /d(d) * u(d)) ^{2}) = sqrt ((1/d^2 * 0.1)^2)

Taking first row,

U(1/d) = sqrt ((1/3^2) *0.1)^2) = ±0.011 mm

3.4. Value of the dielectric constant and its propagated error

- K and u(K)

Show how you calculated these values

C=Ɛ A 1/d C_0= $Ɛ_0$ A 1/d

Slope (S Plastic) = ε A Slope (S Air) = ε_0 A

And since K= $\varepsilon/\varepsilon_0$ **K**=Slope$_{(plastic)}$ / Slope$_{(Air)}$ = 1.251692/ 0.577292 = 2.17

$U(K) = \text{sqrt}\left(\left(d(S_{(plastic)}/S_{(Air)})/d(S_{(plastic)} * U(S_{(plastic)})^2\right) + \left(\left(d(S_{(plastic)}/S_{(Air)})/d(S_{(air))} * U(S_{(air)})^2\right)$

$=\text{sqrt}\left(\left(1/S_{(Air)} * U(S_{(plastic)})^2 + (-S_{(plastic)} * S_{(Air)}^2 * U(S_{(Air)})^2\right)$

$=\text{sqrt}\left((1/0.577 * 0.069)^2 + (-1.25 * 0.577^2 * 0.033)^2\right) = \pm 0.0965$

K=2.17 ± 0.0965

4. Discussion.

(Give a comment on whether your results are in agreement with what was expected or not and mention all the possible sources of error that you may have faced during the experiment).

The results agree with what was expected, and we were able to find the value of K which is close enough to 2 that is to be expected along with few errors that were due to some sources of error in the experiment.

The main sources of error could be the capacitor meter due to its sensitivity and were able to produce a value of **K=2.17 ± 0.0965,** which is a good value to be obtained close to 2. Another source of error could be a human based error while measuring the device.
In conclusion, all experiment was a success with a satisfied value.

References