Summery and Conclusion

In this work we used different commercial sheets of paper **(Edfu**, **Quena& Rakta).**

And we used different types of chemical compounds used as **Fire retardant solutions** (Ammonium phosphate monobasic-Boric Acid – Borax- Sodium Silicate).

This chemical compounds are used in a different concentrations

1- The first part of this work:-

We immersed the paper samples in the solutions made of **Fire retardant solutions** at (5%) concentrations for 5 minutes at room temperature and left papers to dry at room temperature and dry at 105 degree and then measure the breaking length, tear, burst, sizing, roughness and others and then the results of the treated papers are tabulated.

2-The second part of this work:

We used the treated papers and printing them by these concentrations gives the best results. These are the papers used in printing.
We exclude Raktta papers because give bad results.

3-The third part of this work:

We acted the aged process for printing papers by using U.V rays at different times: 10 hours-20 hours-30 hours.

Then we measured the color difference to printing papers. And finally or in the end we chose the best results of papers and act to them scanning electron microscope **(S E M)** which are used to confirm the behavior of papers fiber to examination of the fracture surface of the fibers.

Therefore we recommended the treatment of papers with **Fire retardant solutions** to obtain papers that can with stand for longer time and this paper was not effected by fire or increase

time where not effected to occur the fire.

These papers can be used for a longer time and can be used as documented papers and allied purposes.

4- The fourth part of this work:

- Measure the thermal stability of the best papers by method:
- Flame tests.

5- The fifth part of this work:

Making the writing appear on the burnt papers where some documents are exposed to being burnt totally or partially and the appearing of the treated papers by using some chemical compounds.

The aim of this study is to find the optimum conditions at which the treated samples give the best results concerning all paper properties mechanically and physically. From the results obtained during this study, we can conclude that the treatment of papers **(Edfu&Quena)** ammonium phosphate mono basic. Boric acid. Borax. Sodium silicate.Mg+Cl_2. Sodium silicate+$CaCl_2$.[Boric acid. Borax. Poly vinyl alcohol(as Sizing agent)].

The breaking length increased at treatment papers **(Edfu&Quena)** ammonium phosphate mono basic. Boric acid. Borax. Sodium silicate.Mg Cl_2. Sodium silicate Ca Cl_2. [Boric acid. Borax. Poly vinyl alcohol(as Sizing agent)] .

The burst factor increased at treatment papers **(Edfu&Quena)** ammonium phosphate mono basic. Boric acid. Borax. Sodium silicate+$MgCl_2$. Sodium silicate+$CaCl_2$.[Boric acid. Borax. Poly vinyl alcohol(as Sizing agent)].

The tear factor increased at treatment papers **(Edfu&Quena**) ammonium phosphate mono basic. Boric acid. Borax. Sodium silicate+$MgCl_2$. Sodium silicate+$CaCl_2$.[Boric acid. Borax. Poly vinyl alcohol(as Sizing agent)].

The crystallinity index which measured the degree of the

crystallization increased at treatment papers **(Edfu&Quena)** with ammonium phosphate mono basic. Boric acid. Borax. [Boric acid. Borax. Poly vinyl alcohol(as Sizing agent)].

The whiteness changed at treatment papers **(Edfu&Quena)** ammonium phosphate mono basic. Boric acid. Borax.Sodiumsilicate+$MgCl_2$Sodiumsilicate+$CaCl_2$.[Boricacid. Borax. Poly vinyl alcohol (as Sizing agent)].

The opacity was slightly changed at treatment papers **(Edfu&Quena)** ammonium phosphate mono basic. Boric acid. Borax. Sodium silicate+$MgCl_2$. Sodiumsilicate+Ca Cl_2.[Boric acid. Borax. Poly vinyl alcohol(as Sizing agent)].

Roughness was slightly changed at treatment papers **(Edfu**&**Quena**) ammonium phosphate mono basic. Boric acid. Borax. Sodium silicate.Mg Cl_2. Sodium silicate $CaCl_2$.[Boric acid. Borax. Poly vinyl alcohol(as Sizing agent)].

The total colors difference was slightly changed at treatment papers **(Edfu&Quena)** ammonium phosphate mono basic. Boric acid. Borax.[Boric acid. Borax. Poly vinyl alcohol (as Sizing agent)].but with Sodium silicate+$MgCl_2$.Sodium silicate $CaCl_2$ changed more.

The quality number increased at treatment papers **(Edfu**&**Quena)** ammonium phosphate mono basic. Boric acid. Borax. [Boric acid. Borax. Poly vinyl alcohol] but with Sodium silicate+$MgCl_2$and $CaCl_2$ decreased

The aging for 10 hours during this study, the treatment of papers **(Edfu&Quena**) ammonium phosphate mono basic. Boric acid. Borax. Sodium silicate.Mg Cl_2. Sodium silicate Ca Cl_2. [Boric acid. Borax. Poly vinyl alcohol(as Sizing agent)]. We can conclude that gave the best results

After aging up to 30 hours **the breaking length, Burst factor**, **tear factor** show no significance effect than value before aging.

But at the end of this study the treatment of **(Edfu&Quena)** [Boric acid. Borax. Poly vinyl alcohol (as Sizing agent)] are the best treatment because they give the best results.

Poly vinyl alcohol (as Sizing agent) increase the mechanical and physical properties of **(Edfu&Quena)** papers.

The goodness of **printing** on paper sheets with treatment by FR solutions increased consequently leading to more fastness of printing.

The efficiency of reappearing the writing on the burnt papers is higher in case of papers treated with the FR solutions than papers that are not treated with it. This is because in case of papers treated with FR solutions parts of burnt papers may be collected easily if they are burnt totally but this reappearing process. Depending the structure of the inks used in the writing and reaction of the inks with the chemicals used in the reappearing process.