Physicochemical studies of some disappearing inks

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Disappearing inks have several uses in industry and may be abused by using it in forgery and counterfeiting crimes, to study these inks we prepared disappearing inks of thymolphthalein, phenolphthalein and their mixture. The preparation procedure consists of preparing phenolphthalein and thymolphthalein in different concentrations 0.1, 0.2, 0.4, 0.8 and 1.2% wt/v, their mixture were made by adding equal volume of them to produce (thymolphthalein and phenolphthalein) mixture with concentrations of (0.05, 0.1, 0.2, 0.4 and 0.6 % wt/v).Sodium hydroxid with different concentrations (0.01, 0.1, 0.5 and 1N) were added to the prepared thymolphthalein, phenolphthalein or their mixture with the ratio 1/8 v/v, to give blue, red and violet inks respectively. The ink was used for handwriting by filling a dry 1mm-point felt-tip pen.Evaluation of the prepared disappearing inks happen through studying the handwriting fading on different handwriting surfaces, the used surfaces are paper (Azhar, Xerox, Quena, Edfo and Rakta) and textile fabrics (polyamide, polyester and cotton).It is observed that 1N sodium hydroxide with thymolphthalein, phenolphthalein or their mixture with the ratio 1/8 (v/v) gave the more stable handwriting in all handwriting surfaces thus we studied the increasing its volume therefore we used it with ratio 1/1 (v/v).It is observed that when the concentration of thymolphthalein, phenolphthalein or their mixture increased, the fading time increased for all handwriting surfaces (paper and textile fabrics), thymolphthalein and phenolphthalein with concentrations of 1.2% wt/v gave more handwriting stability than the other concentrations. For their mixture 0.6% wt/v concentration gave more handwriting stability than the other concentrations.Results of studying effects of (0.01, 0.1, 0.5 and 1N) sodium hydroxide in case of thymiolphtalein inks showed that the best handwriting stability obtained when we used 1 N sodium hydroxide with equal volume of thymolphthalien. In case of phenolphthalein inks results showed that the best handwriting stability obtained when we used phenolphthalein with 1 N sodium hydroxide with volume ratio 8/1 (v/v).In case of thymolphthalein and phenolphthalein mixtures, thymolphthalein has no effect on the color of the ink at low concentration of sodium hydroxide because of low pH of the ink, which was slightly lower than thymolphthalein transition range. Phenolphthalein has no effect on the color of the ink at large volume of sodium hydroxide because of formation of carbinol form. The fading time (writing stability) of the used paper surfaces with all the used concentrations of sodium hydroxide following this order:- Azhar > Xerox > Quena > Edfo > Rakta paper.The fading time

(writing stability) of the used textile fabric surfaces with low volume of (0.01, 0.1, 0.5 and 1N) sodium hydroxide following this order:- Polyamide > Polyester > CottonBut with large volume of 1 N sodium hydroxide following this order :-Cotton > Polyamide > PolyesterThe faded handwriting did not respond to the different light of the Projectina Docucenter 3000There are several techniques for deciphering the faded handwriting, when the faded handwriting surfaces were subjected to the thermal effect in a thermostatically controlled oven at 100 ºC for 10 minutes by hanging them with suitable hooks, there was no change in all the faded paper and fabrics handwriting.At 150 ºC for 20 minutes, the faded handwriting of the phenolphthalein ink which contained 0.5 ml of 1N NaOH, was found to become visible and red only in the cases of (Azhar, Xerox paper, polyamide and polyester fabric surfaces). But there is no change in case of Quena, Edfo, Rakta paper and cotton surfaces even with longer heating time. In case of the thymolphthalein inks, there was no change in the faded handwriting. The handwriting of the thymolphthalein and phenolphthalein mixture, which contained 0.5 ml of 1N NaOH was visible and gave red writing only in case of Azhar, Xerox paper, polyamide and polyester surfaces but there is no change on the other surfaces.The faded handwriting was visible when sprayed with alkalin solution or subjected to alkaline vapour.The faded handwriting of the prepared inks in our study did not respond to the different light therefore adding optical brightener to the prepared disappearing inks is so important. Uvitex RSB liquid 150% (Stilbene disulfonic acid triazine derivative) were added to the prepared disappearing ink with ratio 2% (volume / volume), the prepared inks were applied on the used paper and fabrics surfaces. After complete fading, optical examination carried out and all the faded paper and textile surfaces gave fluorescence under short and long UV.In case of using, disappearing inks in forgery and counterfeiting crimes, the optical brightener made forensic examination of the suspected documents and following up the handwriting strokes easy with non-destructive method.