

Sworn expert of the Chamber of Industry and Commerce

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Expert report

Testing the buffer capacity of the eye rinsing solution

Plum Eyewash pH Neutral 4.9% phosphates compared to Cederroth Eye Wash buffered and Previn solution

Mission

I have examined the following two eyewash solutions for their buffering capacity against acids and alkalis:

- Eyewash solution "Plum Eyewash pH Neutral 4.9% Phosphate" (referred to by me as **Plum Neutral** in the further expert opinion)
- Eye rinsing solution "CEDERROTH Eye Wash BUFFERED pH Control" (referred to by me as **CEDERROTH BUFFERED** in this report)
- Eye rinsing solution "Previn solution" (referred to by me as **Previn** in this report)

For the tests, a certain amount of the chemicals to be tested should be presented and then titrated to neutrality with Plum Neutral, CEDERROTH BUFFERED or Previn.

Plum Neutral contains a phosphate buffer in a concentration of 4.9 % and with a pH value of 7.45. The solution is hypertonic in this concentration.

CEDERROTH BUFFERED Contents: "Isotonic Sodium Chloride solution, Borate buffered". The pH-value is 7,53.

The ingredients and the quantitative composition of Previn are not mentioned by the manufacturer. The safety data sheet speaks of an amphoteric substance and gives a pH value "between 7.2 and 7.7". This results in an average value of 7.45. This pH value is therefore used as a reference value in my expert opinion. For Previn, a hypertonicity due to the addition of sodium chloride is also stated. This should lead to an expulsion of the corrosive acids and alkalis due to the increased external osmotic pressure.

Buffer capacity is defined in this report as the amount of an acid or alkali that leads to an upward and downward deviation from the initial pH value of 1.0 pH units. The upper limit for Plum Neutral and Previn is thus pH 8.45, the lower limit is pH 6.45. The upper limit for CEDERROTH BUFFERED is thus pH 8.53, the lower limit is pH 6.53.

In order to get a uniform graphic, the limits 6.5 and 8.5 were added to the graphic. However, the buffer capacity was calculated with the specific limits.

Material and methods

The examinations were carried out by me personally and experienced staff in my laboratory in Geestland with certified chemicals, calibrated measuring instruments and in premises suitable for the examination.

The pH meter model Mettler Toledo Five Easy Plus FP20 was used. This was calibrated every working day with certified standards. The burettes are calibrated by the manufacturer.

All chemicals used were from certified manufacturers at least at the purity level p.a. (pro analysis)

The following lot was available for Plum Neutral

P0062 4801 103032

The following lot was available for CEDERROTH BUFFERED

592

The following lot was available for Previn:

P 300601 A

In buffers, an electrode may only display the measured value with a delay. Therefore, the titrations were not automated but carried out manually and with manual recording of the measured values.

Preliminary remarks and preliminary tests

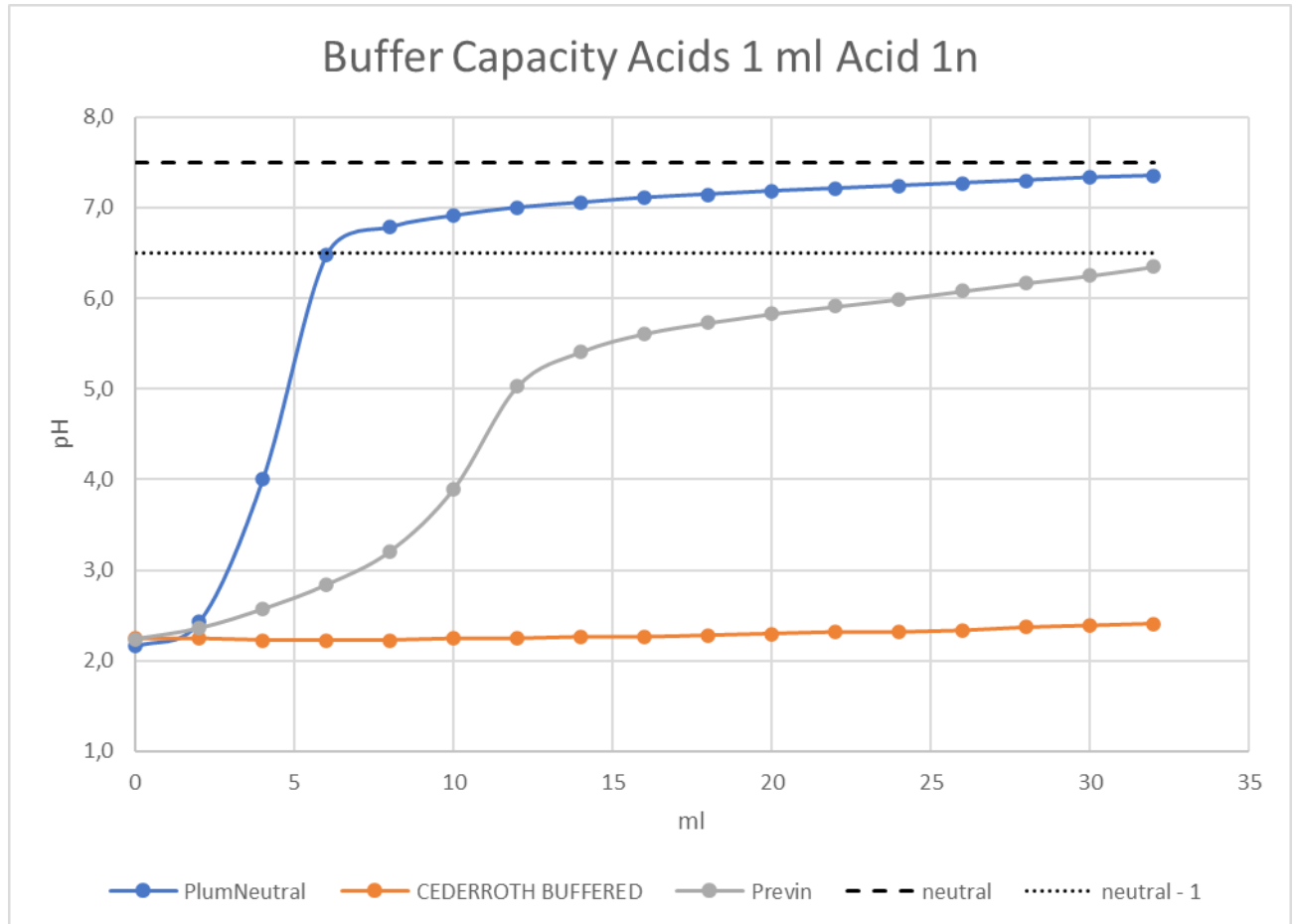
In preliminary tests, I found that the buffer capacity of all solutions was clearly below 1 mol/litre, so that it made no sense to titrate more than 5 ml of the 1-normal solutions. Likewise, the neutralisation capacity determined for the individual acids and bases was strictly stoichiometric, so that it made no sense to test different chemicals or different concentrations of the same chemical in each case.

In the following results, the buffer capacity determined in each case was given in mol/l and calculated from the consumed amount of test solution at the intersection of the respective lower or upper tolerance limit.

Individual results

Acids

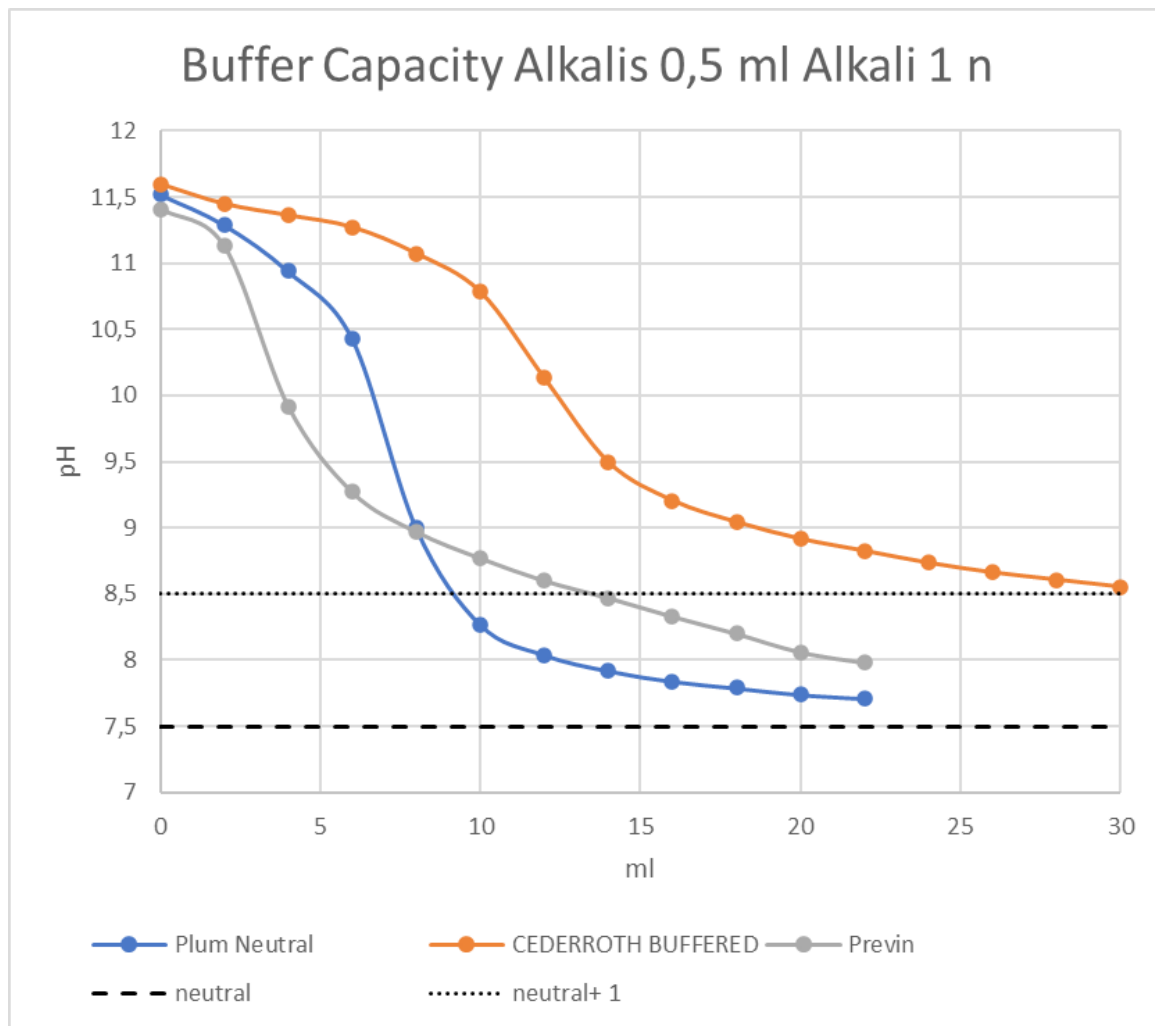
The tests were carried out with 1 normal sulphuric acid.



	Buffer Capacity Acids	Sample Sulfuric Acid MW 98 1 Liter Eye Rinsing Solution neutralises
Plum Neutral	0,17 mol/l	16,7 g
CEDERROTH BUFFERED	0 mol/l	0 g
Previn	0,033 mol/l	3,3 g

Alkalis

The tests were carried out with 0,5 ml 1- normal sodium hydroxide solution.



	Buffer Capacity Alkalis	Sample NaOH MW 40 1 Liter Eye Rinsing Solution neutralises
Plum Neutral	0,055 mol/l	2,2 g
CEDERROTH BUFFERED	0,007 mol/l	0,28 g
Previn	0,036 mol/l	1,4 g

Summary

The buffer capacity against strong acids and alkalis was determined for the three eye rinsing solutions Plum Neutral, CEDERROTH BUFFERED and Previn.

Plum Neutral showed a buffering effect against acids of 0.055 mol/l. CEDERROTH BUFFERED did not show any buffering effect against acids. Previn has a buffer capacity of 0,033 mol/l.

Compared to alkalis, Plum Neutral showed an almost eightfold higher buffering capacity than CEDERROTH BUFFERED (0.055 mol/l versus 0.007 mol/l). Compared to Previn (0,036 mol/l), the buffer capacity of Plum neutral is 1.6 times higher.

Evaluation of the results

The three eyewash solutions studied, **Plum Eyewash pH Neutral 4.9% Phosphates**, **CEDERROTH Eye Wash BUFFERED pH Control** and **Previn solution** are offered with the claim of buffering acids and alkalis. They should be used in preference to unbuffered isotonic sodium chloride solutions in appropriate accidents.

Plum Neutral shows a significant buffering effect against both acids and alkalis. The capacity to acids is slightly higher than to alkalis.

On the other hand, CEDERROTH BUFFERED has no measureable buffering effect on acids and a small effect on alkalis. Because CEDERROTH BUFFERED is isotonic, multiple bottles can be used in a row in the event of an accident. In this respect, a lower buffer capacity is acceptable. There is no efficient buffering effect of CEDERROTH BUFFERED against acids. A pure dilution, as observed with acids, cannot be described as buffering.

Plum Neutral delivers approx. five times higher capacity for acids and approx. twice the capacity for alkalis compared to Previn.

