

How to get the best results with EM Science pH testing products.

The covalently bound indicators used with EM ColorpHast strips remove many sources of error in pH measurement. And you'll have the best possible test results if you understand the possible sources of error. This is particularly important in pH testing, since indicators behave as weak acids or bases in solution and can be influenced by neutral salts, proteins, colloids, organic solvents, and temperature. Several of these potential sources of error are discussed below.

Salt error. When salt concentrations are above 0.2N, indicator equilibrium can shift, causing the pH to shift higher. The degree of this shift depends on the indicator. The salt error of sulfonephthalein, for example, is relatively large since the alkaline form of these indicator ions has two negative charges. In lower- or medium-ionic strength solutions, indicators such as methyl orange or methyl red have a negligible error because their dipolar ionic structure makes them behave as neutral molecules.

Indicator error. In unbuffered and weakly buffered solutions, errors as high as 1 pH unit can occur if the free acid or base of the indicator is used for pH measurement. To avoid this problem, use the salt of the indicator. In most cases, this means that a liquid indicator, not an indicator paper, will give you the best results. In some cases, ColorpHast strips will also give good results because they can be immersed for longer periods of time.

Protein error. Because proteins are amphoteric, they bind to indicator acids through their basic groups, and to indicator bases through their acidic groups. Essentially, the simpler the structure of the indicator, the less interference. EM ColorpHast strips do not exhibit protein error.

Alkaloid error. Essentially, alkaloids interfere with pH measurements in much the same way as proteins. Use EM ColorpHast strips for best results.

Alcohol error. The addition of organic solvents to an aqueous solution changes the dissociation constants with a corresponding shift in the acid base equilibrium. In aqueous-methanol and aqueous-ethanol solutions below 10% alcohol, the shift does not cause a significant pH change. Above 70% alcohol, however, the shift can be as much as 1.5 pH units.

Temperature error. EM ColorpHast test strips and indicator papers are optimized for 20°C. At hotter temperatures, the ionic nature of water changes, and there is a shift in the color range of the indicators. The table below illustrates the magnitude of temperature error for selected indicators¹.

Indicator	18°C (64°F) pH	100°C (212°F) pH
Methyl violet	0.1 - 2.7	0.5 - 1.7
Methyl yellow	2.4 - 4.0	1.9 - 2.9
Methyl orange	3.2 - 4.4	2.5 - 3.7
Methyl red	4.2 - 6.6	4.0 - 6.0
4-Nitrophenol	5.0 - 7.0	5.0 - 6.5
Phenol red	6.8 - 8.4	7.3 - 8.3
Cresol red	7.2 - 8.8	7.6 - 8.8
Phenolphthalein	8.3 - 10.0	8.1 - 9.0
Thymolphthalein	9.3 - 10.5	8.7 - 9.5

¹ From O. Tomicek "Chemical Indicators" London, Butterworths Scientific Publications, 1951.

EM ColorpHast. The answer to fast, accurate, pH testing.

To order EM pH test products, or for further information, contact your nearest EM Science distributor, or call 1-800-222-0342.