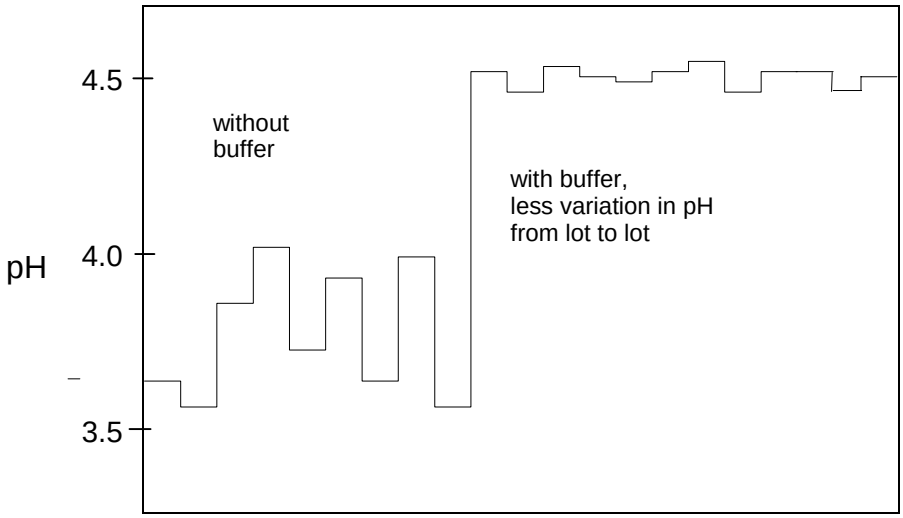
Buffers and Buffering Capacity

A buffer is a partially neutralised acid which resists changes in pH. Salts such as Sodium Citrate or Sodium Lactate are normally used to partially neutralise the acid. Different combinations of acids and salts can be used as buffers, for example, Malic Acid with Sodium Lactate.

Buffers reduce the variation in the pH of an end-product, as shown on the graph at right. pH variation is detrimental to consistent quality.



Why use buffers? Buffers are used specifically to:

- Reduce flavour variation from two pH effects:
  - changes in flavour intensity of flavour chemicals with pH
  - changes in sourness, sweet/sour balance with pH.
- Decrease variation in colour shade of natural colours
- Control gelling in pectin-based products
- Reduce variation in texture from lot to lot

Buffering Capacity is the ability of the buffer to resist changes in pH

- **Buffering Capacity** increases as the molar concentration (molarity) of the buffer salt/acid solution increases
- The closer the buffered pH is to the pKa, the greater the **Buffering Capacity**
- **Buffering Capacity** is expressed as the molarity of Sodium Hydroxide required to increase pH by 1.0

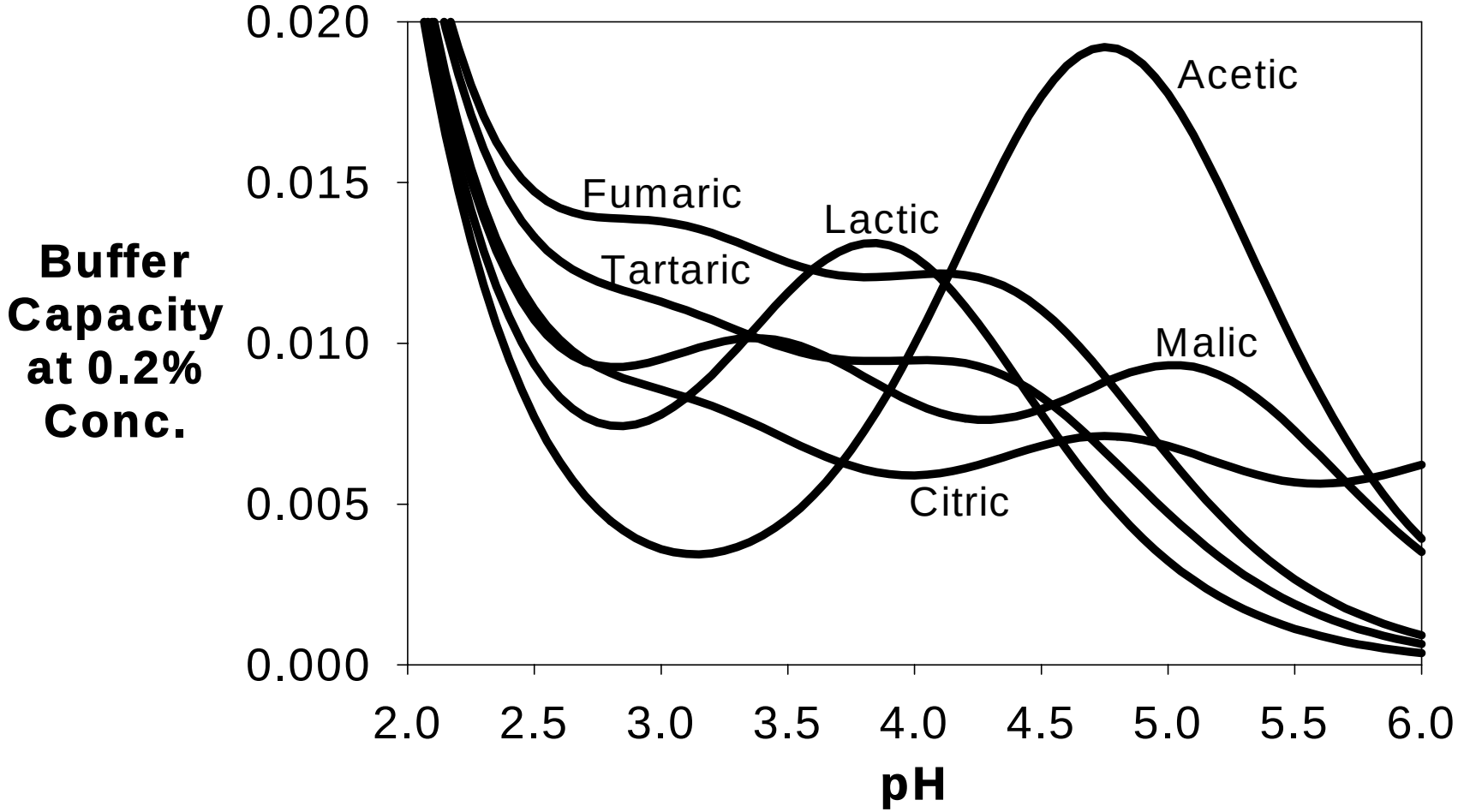
As shown by the graph, ***Acidulants: Buffering Capacity vs. pH***, on the following page, the acidulants with higher molarity like Acetic Acid have a greater buffering capacity. The pKa of the acidulant is the other factor involved. As shown, the closer the buffered pH is to the pKa of the acid, the higher the buffering capacity. We can see that Acetic and Lactic Acids have narrower working ranges than the other acidulants. This is because they are monoprotic acids and therefore the pH range for dissociation is narrower than in the case of polyprotic acids like Malic or Fumaric Acids.

For recommendations on ratios of buffer salts and Malic Acid to achieve specific pHs, refer to Bartek's technical bulletin on the **pH of Buffer Salt/Malic Acid Combinations**.

Additional information is found in: Beynon, R.J. & Easterby, J.S. 1996. Buffer Solutions, The Basics. IRL Press at Oxford University Press, NY.

Acid Buffer Capacity* vs. pH

*Buffer Capacity ≡ Equivalents of acid or base which change pH by 1.0 in 1 Liter of 0.2% acid solution



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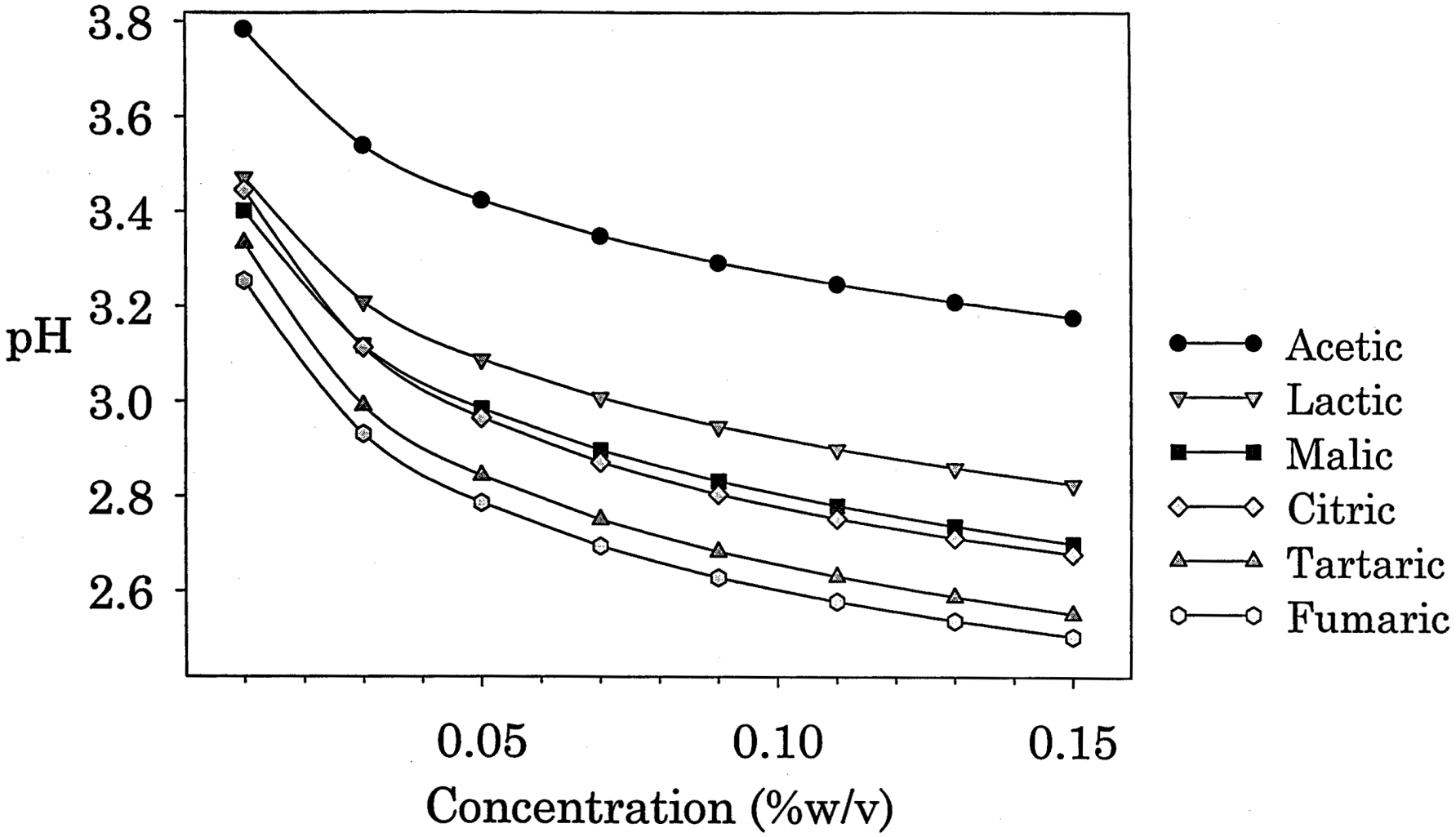
Acidulants: pH vs. Concentration



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