



Determination of Gastric Acidity

Introduction

The gastric secretions are a complex mix of HCl, pepsin, rennet, mineral chlorides (Na, K, Ca, Mg), calcium phosphate and organic material (especially mucus). Generally the acid concentration is 0.1 N, for an healthy human, but this concentration can be modified by many external factors as food or drug ingestion or stress. In case of illness it can be necessary to determine the hyper-acidity or the acidity of the gastric secretion.

Principle

Acidity of gastric juice is determined by an end-point titration at pH 7.00 using as titrant a NaOH solution 0.1 equivalent/l. The sample amount is generally between 0.1 ml (100 µl) and 1 ml (1000 µl). The result is expressed as meq/ml

As for pathological situations, expected results should be between 0.01 meq/ml and may be up to 8meq/ml, it is very difficult to have only one titration method covering this whole range.

According to this fact the pre-programmed method "**Gastric acidity**" is suitable for orientation test and 0.1-2 meq/ml range. Copying this method, it is possible to create 2 others methods changing only few parameters.

GASTRIC AC L

(for 0.01-0.1 meq/ml range)

Minimum speed: 0.02 ml/min
 Maximum speed: 0.5 ml/min
 Sample amount: 500 µl
 (possibly 1000µl)

GASTRIC AC H

(for range > 2 meq/ml)

Maximum volume: 20 ml
 Minimum speed: 0.1 ml/min
 Maximum speed: 5.0 ml/min
 Sample amount: 100 µl
 (possibly 200µl)

Electrode and reagents

PHC3101 Combined pH electrode (E16M327) with CL114 (A94L114) cable

25 mm magnetic barrels A90A410

NaOH 0.1 equivalent/l solution in distilled water (see separate application note but commercially available solution can be used).

The pre-programmed titrant for the method is labelled as "**NaOH Gastric 0.1**"

pH standard IUPAC pH 4.005 (S11M002) and pH 7.00 (S11M004)

Distilled or de-ionised water

Titration Vessel PP 22-45 ml 904-489 (50 pcs) with special holder 923-172 (code number for 10 pcs)

Pipettes for 100µl, 500µl and 1 ml

End Point titration settings (Gastric Acidity)

Burette volume:	10ml
Maximum volume:	40 ml
Stirring speed:	500 rpm
Working mode:	pH
Number of end points:	1
End point:	7.00 pH
Stirring delay:	10 seconds
Minimum speed:	0.02 ml/min
Maximum speed:	3.0 ml/min
Proportional band:	5.00 pH
End point delay:	10 seconds
Sample unit:	µl
Sample amount:	1000 Working ranges (see working range)
pH:	Increasing
Result 1:	ml
Equation unit:	meq/ml
Equation :	V1*CT*1000/SA

Procedure

Put in place the pH3101-9 combined electrode in the suitable hole of the electrode head (see Guide to bayonet accessories booklet)

Calibrate the combined glass electrode with the above mentioned buffer solution

Place the electrode and the delivery tip in opposite positions on electrode head. The ends of electrode and delivery tip should be at the same level in the beaker.

Install the titrant (NaOH gastric 0.1N) and enter its concentration

Pour 20 ml of distilled or de-ionised water into the 22-45 ml beaker and place it on the sample stand of the Titration Manager using a beaker holder

Add the recommended volume of sample

If the expected result is approximately known run the appropriate method

If the expected result is unknown, run, as orientation test with 100µl of sample amount the "Gastric Acidity" method and according to this first result choose the suitable method

Working Ranges

Titrant volume in ml as a function of the gastric acid concentration (in meq/ml) and sample amount (in µl)

	0.01 meq/ml	0.1 meq/ml	1.0 meq/ml	2.0 meq/ml	8.0 meq/ml
100µl	(0.01 ml)	(0.1 ml)	1.0 ml	2.0 ml	8.0 ml
500µl	(0.05 ml)	0.5 ml	5.0 ml	10.0 ml	(40.0 ml)
1000µl	0.1 ml	1.0 ml	10.0 ml	(20.0 ml)	(80.0 ml)

In brackets: titration case not recommended for good accuracy or for titrant consumption, increase or decrease the sample size respectively.

Results with "Gastric Acidity" and a healthy person

Used sample: 500 µl of a mix of HCl and pepsin in de-ionised water

The result corresponds to:

$$R1 = V(\text{titr}) * C(\text{titr}) / V(\text{smp})$$

V(titr) = Titrant volume in ml

C(titr) = Titrant concentration in eq/l

V(smp) = sample volume in ml

Results (3 determinations)

Mean: 0.1067 meq/ml

Standard deviation: 0.0004

Notes

1) The pH3101-9 can be interesting for low maintenance level; Do not forget to store this electrode in KCl 3M solution as recommended by Radiometer Analytical. Note that this electrode is used in the pre-programmed method.

2) Place the electrode and the delivery tip in opposite positions on electrode head. Extremities of electrode and delivery tip are at the same level in the beaker.

3) As the programmed time between two electrodes calibrations is 1 day the corresponding icon on the main menu will always be "cloudy" after a calibration. See the user's guide (D21T043) chapter 2, p. 12.

4) For quick determinations, it is possible to use an end-point Titration Manager fitted with a 25 ml burette cylinder, 1000 µl of sample volume and the pre-programmed method without change. With these conditions the working range is 0.02 meq/ml - 4.0 meq/ml.