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(Ed.) Patricia Cunniff  
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## 42. Vegetable Products, Processed

Thomas R. Mulvaney, *Chapter Editor*  
Food and Drug Administration

### Subchapter 1 CANNED VEGETABLES

#### 42.1.01

#### AOAC Official Method 968.30 Canned Vegetables Drained Weight Procedure 1988

##### A. Sieves

*See Definition of Terms and Explanatory Notes.* Use 8" (20 cm) diameter for containers  $\leq 3$  lb (1.36 kg) or 12" (30 cm) diameter for containers  $> 3$  lb.

##### B. Determination

Weigh full can, open, and pour entire contents on No. 8 sieve (use 7/16" sieve for canned tomatoes). Without shifting product, incline sieve at ca 17–20° angle to facilitate drainage. Drain 2 min, directly weigh either drained solids or free liquid, and weigh dry empty can. From weights obtained, determine % liquid and % drained solid contents.

#### 42.1.02

#### AOAC Official Method 945.68 Canned Vegetables Sample Preparation Procedure

(a) *Products composed of solid and liquid portions.*—See 920.149(d) (see 37.1.07). If only solid portion is required for analysis or examination, thoroughly grind drained vegetables in mortar or food chopper. If composite of solid and liquid portion is required, thoroughly grind entire contents of can in mortar or food chopper. In all cases, thoroughly mix portion used and store balance in glass-stoppered container. Unless analysis is to be completed in reasonably short time, determine  $H_2O$  in portion of sample prepared as above. To prevent decomposition, dry remainder, grind, mix thoroughly, and store in glass-stoppered container. (Second  $H_2O$  determination is required in this method.)

(b) *Commixed products (tomato juice, tomato catsup, strained vegetables).*—Thoroughly shake unopened container to incorporate any sediment. Transfer entire contents to large glass or porcelain dish, and mix thoroughly continuing stirring  $> 1$  min. Transfer

#### 42.1.03

#### AOAC Official Method 978.18 Water Activity of Canned Vegetables Final Action

##### A. Principle

Water activity,  $a_w$ , is ratio of vapor pressure of  $H_2O$  in product to vapor pressure of pure  $H_2O$  at same temperature. It is numerically equal to 1/100 of relative humidity (RH) generated by product in closed system. RH can be calculated from direct measurement of partial vapor pressure or dew point or measured indirectly by sensors whose physical or electric characteristics are altered by RH to which they are exposed. Instruments are checked or calibrated on basis of RH generated by standard salt slushes.

##### B. Instruments and Systems

(Select 1 of following instruments or systems to perform test. Each has different application limitations because of interferences from other volatile components of products being measured. Check with instrument manufacturer for more specific limitations.)

(a) *Change in electrical conductivity of immobilized salt solution.*—Instrument available from Beckman Industrial, Rosemount Analytical Div., 89 Commerce Rd, Cedar Grove, NJ 07009; Nova Sina AG, Andreastrasse 7-11, CH 8050, Zurich, Switzerland; Rotronic Instrument Corp., 160 E. Main St, Huntington, NY 11743. Immobilized salt sensors are affected by polyols such as glycerol and glycol and by volatile amines.

(b) *Change in electrical capacitance of polymer thin films.*—Instrument available from General Eastern Instruments, 50 Hunt St, Watertown, MA 02172. Polymer thin film sensors are affected by  $CH_3COOH$ .

(c) *Dew points by chilled mirror technique.*—Instrument available from EG&G, Environmental Equipment Division, 217 Middlesex Turnpike, Burlington, MA 01803 or General Eastern Instruments. Dew point measurements can be affected by condensables with lower critical temperature than  $H_2O$ .

(d) *Longitudinal change in dimensions of water-wicking fibers.*—Instrument available from G Luft Metallbarometerfabrik, D-7, Postfach 692, Neue Weinsteige 22, Stuttgart, Germany.

(e) *Partial water vapor pressure by manometric system.*—Partial  $H_2O$  vapor pressure measurements can be made useless by living products that respire, such as grains or nuts; by active fermentation; or by products that expand excessively when subjected to high vacuum.

(f) *Relative weight of moisture sorbed by endogenous hydrophilic*

**C. Apparatus and Reagents**

(As needed for instrument or system selected.)

- (a) *Dew point instrument*.—Equipped to measure temperature to  $\pm 0.1^\circ$ . See 978.18B(c).
- (b) *Forced-draft cabinet*.—Constant temperature, set to maintain  $25 \pm 1^\circ$ ; capacity  $\geq 0.06 \text{ m}^3$  (2 cu ft); with access port to accommodate instrument sensor leads. Use in conjunction with (c).
- (c) *Insulated box with cover*.—Large enough to hold test container, (e), and small enough to fit in forced-draft cabinet, (b); with access port to accommodate instrument sensor leads. Protect test container from short-term temperature fluctuations.
- (d) *Manometric system*.—Sensitive to pressure differential of  $\pm 0.01 \text{ mm Hg}$  (1.33 Pa). See 978.18B(e).
- (e) *Test containers*.—120 or 240 mL (4 or 8 oz) wide-mouth or Mason glass jars with Al- or Teflon-lined screw caps and gaskets. Check integrity of cap seals and sensor leads by any means available, e.g., ability of system to hold vacuum, using Tezala coil.
- (f) *Water bath*.—Capable of maintaining temperature constant within  $0.1^\circ$  at  $25 \pm 1^\circ$ ; capacity sufficient to hold measuring chamber of selected apparatus.
- (g) *Hydrophilic solid*.—Microcrystalline cellulose, Type PH-101 (FMC Corp., Pharmaceutical and Bioscience Division, 1735 Market St, Philadelphia, PA 19103, or equivalent).
- (h) *Reference salts*.—ACS reagent grade, fine crystal. See Table 978.18.

**Table 978.18 Water Activity of Reference Salt Slushes at 25°**

Salt	$a_w$	Salt	$a_w$
MgCl <sub>2</sub>	0.328	KBr	0.809
K <sub>2</sub> CO <sub>3</sub>	0.432	(NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub>	0.810
Mg(NO <sub>3</sub> ) <sub>2</sub>	0.529	KCl	0.843
NaBr	0.576	Sr(NO <sub>3</sub> ) <sub>2</sub>	0.851
CoCl <sub>2</sub>	0.649	BaCl <sub>2</sub>	0.902
SrCl <sub>2</sub>	0.709	KNO <sub>3</sub>	0.938
NaNO <sub>3</sub>	0.743	K <sub>2</sub> SO <sub>4</sub>	0.973
NaCl	0.763		

**D. Preparation of Reference Salt Slushes**

Place selected reference salt in test container to depth of ca 4 cm for more soluble salts (lower  $a_w$ ), to depth of ca 1.5 cm for less soluble salts (higher  $a_w$ ), and to intermediate depth for intermediate salts. Add H<sub>2</sub>O in ca 2 mL increments, stirring well with spatula after each addition, until salt can absorb no more H<sub>2</sub>O as evidenced by free liquid. Keep free liquid to minimum needed to establish saturation of salt with H<sub>2</sub>O. Slushes are ready for use upon completion of mixing, and are usable indefinitely (except for some high  $a_w$  salts susceptible to bacterial attack), if contained in manner to prevent substantial evaporation losses. Some slushes, e.g., NaBr, may solidify gradually by crystal coalescence, with no effect on  $a_w$ .

**E. Calibration**

Select  $\geq 5$  salts to cover  $a_w$  range of interest or range of sensor being used. Measure humidity generated by each salt slush in terms of instrument readout, as in 978.18F. Plot readout against  $a_w$  values given in Table 978.18 for selected salts, using cross-section paper scaled for reading to 0.001  $a_w$  unit. Draw best average smooth line through plotted points. Use this calibration line to translate sensor instrument readout of samples to  $a_w$  or to check vapor pressure or dew point instruments for proper functioning.

**F. Determination**

Place calibration slush or sample in forced-draft cabinet, (b), or H<sub>2</sub>O bath, (f), until temperature is stabilized at  $25 \pm 1^\circ$ . Transfer salt slush or sample to test container, (e), seal container with sensing device attached, and place in temperature control device. Use volume of sample or slush  $> 1/20$  total volume sample container plus any associated void volume of sensing system, but not so much as to interfere with operation of system. Record instrument response at 15, 30, 60, and 120 min after test container is placed in temperature control device, or record response on strip chart. Two consecutive readings, at indicated intervals, which vary by  $< 0.01 a_w$  unit are evidence of adequately close approach to equilibrium. Continue readings at 60-min intervals, if necessary. Convert last reading to  $a_w$  by calculation from physical measurements or by reference to calibration line. Make all measurements within range of calibration points; do not extrapolate calibration line. Make all measurements in same direction of change, and, if required by properties of sensor, expose sensor to controlled RH below ambient before starting each measurement.

Reference: JAOAC 61, 1166(1978).

**42.1.04**

**AOAC Official Method 961.12  
pH of Acidified Foods  
First Action 1981  
Final Action 1982**

**A. Principle**

pH is measurement of H ion activity and indicates acidity. It may be measured by determining electric potential between glass and reference electrodes, using commercial apparatus standardized against NIST primary standard pH buffers.

**B. Apparatus and Reagents**

- (a) *pH meter*.—Commercial instrument with scale graduated in  $\leq 0.1$  pH unit and reproducibility of  $\leq 0.05$  unit. Some instruments permit expansion of any 2 pH unit range to cover entire scale and have accuracy of ca  $\pm 0.01$  pH unit and reproducibility of  $\pm 0.005$  pH unit. Other instruments have digital read-outs with similar capabilities. Operate meter in accordance with manufacturer's instructions. In this method, several procedures for standardization and operation of pH meters and electrodes are outlined. When these procedures differ from manufacturer's instruction, the latter should prevail, except that NIST standard buffers must be used as primary reference. Working buffer standards should be checked at least daily against NIST reference buffers.

(b) *Standard buffer solutions*.—See 964.24 and Table 964.24 (see A.1.04).

(c) *Electrodes*.—Glass membrane indicator electrode and calomel reference electrode (single or combination). Keep calomel electrodes filled with saturated KCl solution because they may be damaged if allowed to dry out. Maintain uniform temperature of ca  $25^\circ$  for electrodes, standard buffer solutions, and samples. Soak new electrodes several hours in distilled or deionized H<sub>2</sub>O before use. Store glass electrode in pH 4 buffer. Store reference electrodes in their own electrolyte filling solution. Store combination electrode in pH 4 buffer with a few drops of saturated KCl solution added. Store electrodes in manner consistent with manufacturer's recommendations if they differ from above. Store electrodes so that junction and hole are covered. Rinse electrodes with next solution to be measured.