## Butalbital, Acetaminophen, and Caffeine Tablets

» Butalbital, Acetaminophen, and Caffeine Tablets contain not less than 90.0 percent and not more than 110.0 percent of the labeled amounts of butalbital ($C_{11}H_{16}N_2O_3$), acetaminophen ($C_8H_9NO_2$), and caffeine ($C_8H_{10}N_4O_2$).

**Packaging and storage**—Preserve in tight containers.

**USP Reference standards** ⟨11⟩—
USP Acetaminophen RS
USP Butalbital RS
USP Caffeine RS

**Identification**—The retention times of the butalbital peak, the acetaminophen peak, and the caffeine peak in the chromatogram of the *Assay preparation* correspond to those of the butalbital peak, the acetaminophen peak, and the caffeine peak in the chromatogram of the *Standard preparation,* as obtained in the *Assay.*

**Dissolution,** *Procedure for a Pooled Sample* ⟨711⟩—

*Medium:* water; 900 mL.

*Apparatus 2:* 50 rpm.

*Time:* 30 minutes.

*Mobile phase* and *Chromatographic system*—Prepare as directed in the *Assay.*

*Standard preparation*—Prepare a solution in methanol having known concentrations of about 0.02*A* mg of USP Acetaminophen RS per mL, 0.02*B* mg of USP Butalbital RS per mL, and 0.02*C* mg of USP Caffeine RS per mL, in which *A, B,* and *C* are the labeled amounts, in mg, of acetaminophen, butalbital, and caffeine, respectively, per Tablet. Transfer 5.0 mL of this solution to a 100-mL volumetric flask, dilute with water to volume, and mix.

*Procedure*—Pass a portion of the solution under test through a suitable filter having a 10-µm or finer porosity. Separately inject equal volumes (about 20 µL) of the filtrate and the *Standard preparation* into the chromatograph, record the chromatograms, and measure the responses for the major peaks. Calculate the quantities, in mg, of butalbital ($C_{11}H_{16}N_2O_3$), acetaminophen ($C_8H_9NO_2$), and caffeine ($C_8H_{10}N_4O_2$) dissolved by the same formula:

$$900C(r_U / r_S)$$

in which C is the concentration, in mg per mL, of the appropriate USP Reference Standard in the *Standard preparation;* and $r_U$ and $r_S$ are the peak responses of the corresponding analyte obtained from the solution under test and the *Standard preparation,* respectively.

*Tolerances*—Not less than 80% *(Q)* of the labeled amounts of $C_{11}H_{16}N_2O_3$, $C_8H_9NO_2$, and $C_8H_{10}N_4O_2$ is dissolved in 30 minutes.

**Uniformity of dosage units** ⟨905⟩: meet the requirements.

**Assay**—

*Mobile phase*—Transfer 800 mg of monobasic potassium phosphate to a 2000-mL volumetric flask. Dissolve in 1100 mL of water, dilute with methanol to volume, and mix. Pass through a suitable filter having a 0.5-µm or finer porosity. Make adjustments if necessary (see *System Suitability* under *Chromatography* ⟨621⟩).

*Internal standard solution*—Prepare a solution of phenacetin in methanol containing 0.65 mg per mL.

*Butalbital standard stock solution*—Dissolve an accurately weighed quantity of USP Butalbital RS in *Internal standard solution* to obtain a solution having a known concentration of about 0.01*B* mg per mL, *B* being the labeled amount, in mg, of butalbital per Tablet, sonicating and shaking the solution, if necessary, to achieve complete dissolution.

*Caffeine standard stock solution*—Dissolve an accurately weighed quantity of USP Caffeine RS in *Internal standard solution* to obtain a solution having a known concentration of about 0.01*C* mg per mL, *C* being the labeled amount, in mg, of caffeine per Tablet, sonicating and shaking the solution, if necessary, to achieve complete dissolution.

*Standard preparation*—Transfer to a 50-mL volumetric flask about 0.1*A* mg of USP Acetaminophen RS, *A* being the labeled amount, in mg, of acetaminophen per Tablet, 10.0 mL of *Butalbital standard stock solution,* and 10.0 mL of *Caffeine standard stock solution,* sonicate for 5 minutes, dilute with water to volume, and mix. This solution contains about 0.002*B* mg of butalbital, 0.002*A* mg of acetaminophen, and 0.002*C* mg of caffeine per mL. Pass a portion of this solution through a suitable filter having a 0.5-µm or finer porosity, and use the filtrate as the *Standard preparation.*

*Assay preparation*—Weigh and finely powder not fewer than 20 Tablets. Transfer an accurately weighed portion of the powder, equivalent to about 1 average Tablet weight, to a 200-mL volumetric flask, add *Internal standard solution* to volume, and mix. Sonicate for 15 minutes, mix, and allow to cool and settle. Transfer 20.0 mL of the clear supernatant to a 50-mL volumetric flask, dilute with water to volume, and mix. Pass a portion of this solution through a suitable filter having a 0.5-µm or finer porosity, discarding the first 5 mL of the filtrate. Use the clear filtrate as the *Assay preparation.*

*Chromatographic system* (see *Chromatography* ⟨621⟩)—The liquid chromatograph is equipped with a 216-nm detector and a 4-mm × 25-cm column that contains packing L1. The flow rate is about 2 mL per minute. Chromatograph the *Standard preparation,* and record the peak responses as directed for *Procedure:* the relative retention times are about 0.16 for acetaminophen, 0.33 for caffeine, 0.77 for phenacetin, and 1.0 for butalbital; the resolution, *R,* between any two peaks is not less than 1.2; the column efficiency, calculated from the butalbital peak, is not less than 1000 theoretical plates; and the relative standard deviations of the acetaminophen, caffeine, and butalbital responses for replicate injections are not more than 2.0%.

*Procedure*—Separately inject equal volumes (about 10 µL) of the *Standard preparation* and the *Assay preparation* into the chromatograph, record the chromatograms, and measure the peak responses for the major peaks. Calculate the quantities, in mg, of butalbital ($C_{11}H_{16}N_2O_3$), acetaminophen ($C_8H_9NO_2$), and caffeine ($C_8H_{10}N_4O_2$) in the portion of Tablets taken by the same formula:

$$500D(R_U / R_S)$$

in which *D* is the concentration, in mg per mL, of the appropriate USP Reference Standard in the *Standard preparation;* and $R_U$ and $R_S$ are the peak response ratios of the corresponding analyte to phenacetin obtained from the *Assay preparation* and the *Standard preparation,* respectively.



## Butalbital and Aspirin Tablets

### DEFINITION

Butalbital and Aspirin Tablets contain NLT 90.0% and NMT 110.0% of the labeled amounts of butalbital ($C_{11}H_{16}N_2O_3$) and aspirin ($C_9H_8O_4$).

### IDENTIFICATION

• **A.** The retention times of the butalbital and aspirin peaks of the *Sample solution* correspond to that of the butalbital peak of *Standard solution A* and the aspirin peak of *Standard solution B,* as obtained in the *Assay.*