Vacuum insulation panel (VIP) is known to be the most effective insulation material. However, the usage areas of VIPs are restricted because of their high production costs. The core of VIP is the most important item affecting the cost of VIP. In this study, to obtain VIPs, which are provided with minimum thermal conductivity resistance value ($R=5 \text{ m}^2\text{ K/mW}$), was aimed for the optimal thickness of the panel (<40 mm). Therefore, 14 different core samples of VIP were produced by using various types of powders (fumed silica, precipitated silica, perlite, and diatomite), opacifiers (silicon carbide, carbon black, and titanium dioxide), and fibers (glass fiber, organic fiber, and cellulosic fiber). By using appropriate test methods, the physical properties of core samples such as unit weight, porosity, mass per volume and mechanical properties, their uniaxial compressive strength, tensile strength, and dimensional stability and also thermal conductivity coefficient in vacuum were determined. Results were compared with values of reference materials. The most appropriate compression pressure used in the manufacture of core sample was 27.5 kN. In addition, taking into account the benefit-cost relationship, the results of this study showed that the mix of fumed silica and precipitated silica (powder material), silicon carbide (opacifier), and glass fiber (fiber) was determined as the most suitable raw materials.