Highlights

1. An optical thickness based scaling is developed and applied to least-squares spherical harmonics method (LSPN) for solving neutron transport equation.
2. Preservation of thick diffusion limit for the scaled LSPN using the scaled continuous finite element in space is demonstrated.
3. The method is accurate in test problems with high-scattering-ratio materials (water, heavy water and natural carbon) and over tens of mean free paths.