Spectral unmixing aims at estimating the proportions (abundances) of pure spectrums (endmembers) in each mixed pixel of hyperspectral data. Recently, a semi-supervised approach, which takes the spectral library as prior knowledge, has been attracting much attention in unmixing. In this paper, we propose a new semi-supervised unmixing model, termed framelet-based sparse unmixing (FSU), which promotes the abundance sparsity in framelet domain and discriminates the approximation and detail components of hyperspectral data after framelet decomposition. Due to the advantages of the framelet representations, e.g., images have good sparse approximations in framelet domain, and most of the additive noises are included in the detail coefficients, the FSU model has a better antinoise capability, and accordingly leads to more desirable unmixing performance. The existence and uniqueness of the minimizer of the FSU model are then discussed, and the split Bregman algorithm and its convergence property are presented to obtain the minimal solution. Experimental results on both simulated data and real data demonstrate that the FSU model generally performs better than the compared methods.