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One of the expected signatures of Many-Body Localization is logarithmic (as opposed to ballistic) growth of bipartite entanglement starting from a product initial condition. For a class of disordered quantum XY chains, and a large class of product initial states, we prove that the entanglement satisfies a constant bound, independent of time and system size. Therefore, although disordered XY chains display many of the expected generic features of Many-Body Localization, the dynamics of entanglement appears to be even more localized than is generically expected and observed numerically in other model systems. This research was partially supported by the National Science Foundation under Grants DMS-1069320 (G.S.) and DMS-1515850 (B.N.), and by a grant from the Simons Foundation (#301127 to R.S.). (Received August 29, 2015)