Tsa1 and Tsa2 are two typical 2-Cys Peroxiredoxins (2-Cys Prxs) from *Saccharomyces cerevisiae* that share high homology (86% identity and 96% similarity) and high peroxidatic activity over H$_2$O$_2$ ($\sim$10$^7$ M$^{-1}$s$^{-1}$). 2-Cys Prxs employ a very reactive cysteine residue (peroxidatic cysteine, C$_P$) to reduce H$_2$O$_2$, giving rise to cysteine sulfenic acid (C$_P$-SOH), which then condenses with a second cysteine residue (resolving cysteine, C$_R$), forming an inter-molecular disulfide bond, that is frequently reduced by thioredoxin (Trx). Under highly oxidative conditions, C$_P$-SOH can be overoxidized (C$_P$-SO$_2$H), in a Trx dependent manner, which results in the loss of peroxidase activity and the formation of high molecular weight (HMW) complexes. Previously, we established that Glu$^{50}$ and Arg$^{146}$ are two residues relevant for the reduction of Tsa1 by Trx1. Therefore, the objectives of this work are the characterization of Tsa1 and Tsa2 reduction by Trx1. Taking advantage of redox dependent changes in Tsa1/Tsa2 intrinsic fluorescence (Trx1 do not present detectable fluorescence), we attempted to measure the reductive half part of the catalytical cycle. Tsa1/Tsa2 (2$\mu$M) samples were previously pre-oxidized by H$_2$O$_2$ (2.2 $\mu$M) and afterwards rates of reduction were determined using reduced Trx (10 $\mu$M). Trx1 reduced Tsa1 and Tsa2 with high efficiency, attaining rate constants in the 10$^7$ M$^{-1}$s$^{-1}$ range. Overoxidation rates of Tsa1 and Tsa2 were also investigated, using high amounts of H$_2$O$_2$ (10 eq.) in a Trx independent manner. In these conditions, the rate constant of Tsa1 overoxidation by H$_2$O$_2$ was determined as $k = 4.75 \times 10^6$ M$^{-1}$s$^{-1}$. In contrast, no Tsa2 overoxidation was detected. Contribution of Trx to the Prx overoxidation is complex and use of site-directed mutant proteins are in progress. If confirmed, the remarkable differences in the overoxidation rates of Tsa1 and Tsa2 by H$_2$O$_2$ point out no redundant roles of these enzymes.

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