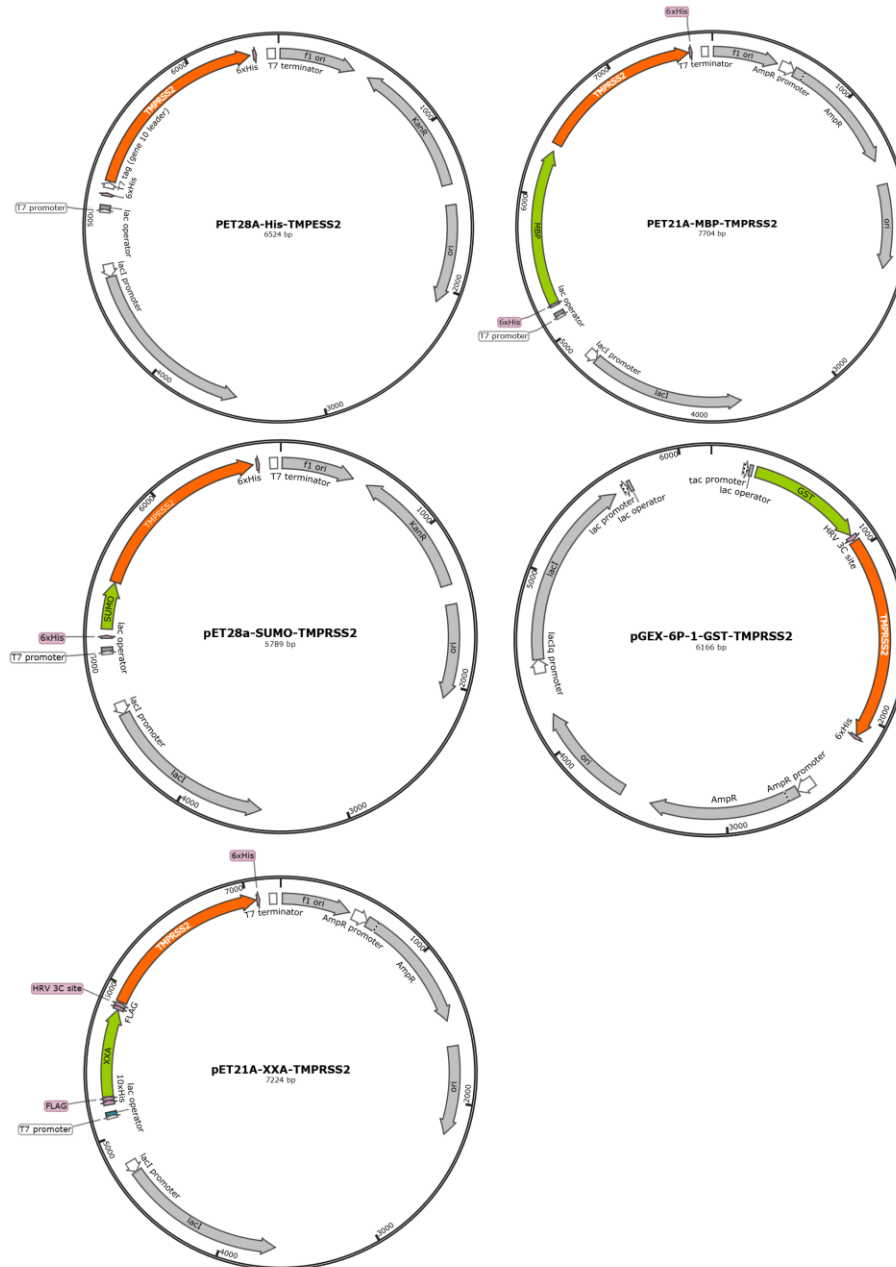
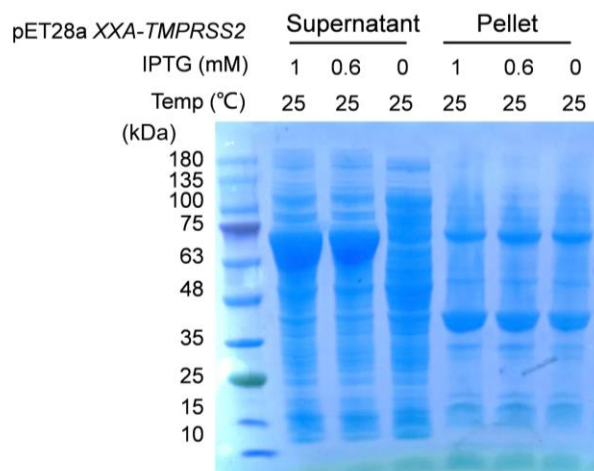


Supplementary Figure S1. Schematic representation of multi-domain protein TMPRSS2.TM: transmembrane domain; LDLRA: low-density lipoprotein receptor A domain; SRCR: scavenger receptor cysteine-rich domain; Protease Domain: serine protease domain.

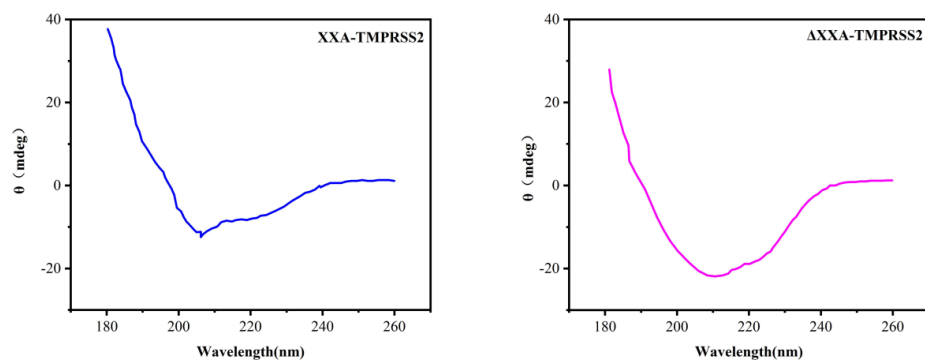
Plasmid	Inserted gene	Vector	Selection marker	Fusion tag
pET-His-TMPRSS2	His-TMPRSS2	pET-28	Kan	None
pET-MBP-TMPRSS2	MBP-TMPRSS2	pET-21a (+)	Amp	MBP
pET-SUMO-TMPRSS2	SUMO-TMPRSS2	pET-28	Kan	SUMO
pGEX-GST-TMPRSS2	GST-TMPRSS2	pGEX-6P-1	Amp	GST
pET-XXA-TMPRSS2	His-XXA-TMPRSS2	pET-21a (+)	Amp	XXA-His



Supplementary Figure S2. Recombinant plasmids constructed in this study. Schematic diagram of different recombinant plasmids expressing His-TMPRSS2, MBP-TMPRSS2, SUMO-TMPRSS2, GST-TMPRSS2 and XXA-TMPRSS2.



Supplementary Figure S3. *XXA-TMPRSS2* was induced at different condition. *E. coli* cells transfected with pET-28a-*XXA-TMPRSS2* were induced with 0.6 or 1 mM IPTG at 25 °C for 16 hours, and the soluble supernatant and insoluble pellet fractions were analyzed separately.



Supplementary Figure S4. CD spectrum of XXA-TMPRSS2 and Δ XXA -TMPRSS. The CD spectrum of XXA-TMPRSS2 and Δ XXA -TMPRSS protein were captured using a spectrophotometer over the entire UV wavelength range (180-260 nm) at 20 °C.

Name	Sequence
AXX	MQDELADAKSAIEAKHAVSDAAKKETVTGAAADVQEARDVTQDQRQNLGYAEQK AADTLGDVAAAQEAYESAKQRASEAEGAKSTASELGGAERAVRDAAGGAEGAGR DAQGAAREGLKGAEGAGATDEARRHAEDVADTAKEYSELKGDAGEGLGRAQAKG EDLAGDASKAAQDAADRLK
XXA	KLRDAADQAAKSADGALDEGKAQARGLGKADGKLESYKEKATDAVEAHHRAEDA AEAGKLGERAAGQADRGAGEAGGAADRVAREASGGLESATSKAGEAAESARQKAE YAEQAAAKDGLTAAKQEAYGLNQRQDQTVDRATEQVDAAAGTVTEKVKQAADSV AHKATEIASKAKDALSEDQM

Supplementary Table S1. Amino acid sequences of antifreeze protein AXX and artificial protein XXA.