

Supplementary data

Supplementary Table 1: Effect of NaOH on the tensile properties of thermoplastic starch, Zein, and starch-zein composites.

Treatment	Ultimate tensile stress (MPa)	Elongation at break (%)	Young's modulus (MPa)
Zein in water	4.18 (± 0.22) ^d	2.2 (± 0.15) ^a	555.74 (± 31.20) ^d
Zein in 0.1M NaOH	5.72 (± 0.28) ^e	2.94 (± 0.24) ^a	656.74 (± 23.66) ^e
Starch in water	2.24 (± 0.05) ^a	20.98 (± 0.89) ^c	32.12 (± 0.95) ^a
Starch in 0.1M NaOH	2.30 (± 0.10) ^a	21.40 (± 1.52) ^c	31.62 (± 1.95) ^a
Starch-zein composites in water	3.24 (± 0.19) ^b	14.48 (± 1.04) ^b	155.40 (± 14.88) ^b
Starch-zein composites in 0.05M NaOH	3.44 (± 0.11) ^{bc}	15.68 (± 0.56) ^b	167.70 (± 11.80) ^{bc}
Starch-zein composites in 0.1M NaOH	3.64 (± 0.05) ^c	15.60 (± 0.29) ^b	174.66 (± 4.67) ^c
Starch-zein composites in 0.2M NaOH	3.30 (± 0.19) ^b	20.20 (± 1.68) ^c	140.98 (± 11.50) ^b

Means are followed by standard deviation in brackets. Means with different letters in the same column are significantly different ($p < 0.05$).

Supplementary Table 2: The effect of NaOH on the deconvoluted FTIR spectra in the amide I region of thermoplastic starch-zein and starch-zein composite films.

Treatment	Area (%)			α -helix: β -sheets ratio
	α -helix (1648-1654)	β -Sheets (1618-1624)	β -turns (1679-1680)	
Zein in H₂O	63.91 (\pm 1.40) ^b	30.00 (\pm 1.59) ^a	6.10 (\pm 0.19) ^a	2.13 (\pm 0.16) ^b
Zein in 0.1M NaOH	63.46 (\pm 0.16) ^b	30.78 (\pm 0.19) ^a	5.76 (\pm 0.35) ^a	2.06 (\pm 0.01) ^b
Starch-zein composite in water	55.74 (\pm 1.44) ^a	37.16 (\pm 2.50) ^b	7.10 (\pm 1.06) ^a	1.50 (\pm 0.14) ^a
Starch-zein composite in 0.05M NaOH	56.00(\pm 0.85) ^a	37.75 (\pm 1.04) ^b	6.25 (\pm 0.19) ^a	1.48 (\pm 0.06) ^a
Starch-zein composite in 0.1M NaOH	53.48 (\pm 1.84) ^a	38.36 (\pm 0.72) ^b	8.16 (\pm 2.57) ^a	1.39 (\pm 0.02) ^a
Starch-zein composite in 0.2M NaOH	52.11(\pm 1.26) ^a	38.94 (\pm 0.04) ^b	8.95 (\pm 1.21) ^a	1.34 (\pm 0.03) ^a

Means are followed by the standard deviation in brackets. Means with different letters in the same column are significantly different ($p < 0.05$).

Supplementary Table 3: Effect of NaOH on the thermal stability of thermoplastic starch, Zein and starch-zein composites.

Treatment	Temperature (°C)				Weight %
	T _o	T _{25%}	T _{50%}	T _{max}	W500
Zein in H₂O	242.50 (±1.15) ^a	280.07 (±1.03) ^a	330.53 (±0.28) ^d	328.83 (±0.49) ^d	20.54 (±0.00) ^{bcd}
Zein in 0.1M NaOH	242.21 (±0.39) ^a	278.80 (±1.24) ^a	328.67 (±0.32) ^e	327.76 (±2.00) ^d	20.04 (±1.82) ^b
Starch in H₂O	292.13 (±0.00) ^c	306.07 (±0.44) ^c	323.53 (±0.35) ^f	328.20 (±0.43) ^d	10.11 (±0.28) ^a
Starch in 0.1M NaOH	277.36 (±2.38) ^{bc}	290.39 (±0.11) ^c	316.51 (±0.03) ^e	315.02 (±0.00) ^c	18.93 (±0.05) ^b
Starch-zein composite in H₂O	281.15 (±1.39) ^c	295.98 (±1.04) ^d	317.87 (±0.44) ^e	311.96 (±0.87) ^b	21.17 (±0.17) ^{bcd}
Starch-zein composite in 0.05M NaOH	281.35 (±0.96) ^c	295.21 (±0.31) ^d	316.84 (±0.42) ^e	310.11 (±0.87) ^b	21.81 (±0.39) ^{cd}
Starch-zein composite in 0.1M NaOH	275.15 (±2.09) ^b	289.08 (±0.52) ^{bc}	313.65 (±0.07) ^b	309.80 (±0.43) ^b	22.99 (±0.14) ^c
Starch-zein composite in 0.2M NaOH	273.93 (±0.55) ^b	286.43 (±2.10) ^b	310.43 (±0.86) ^a	306.66 (±0.42) ^a	22.82 (±0.45) ^c

Means are followed by the standard deviation in brackets. Means with different letters in the same column are significantly different ($p < 0.05$). T_o is the temperature at onset degradation, T_{25%} is the temperature at 25% weight loss, T_{50%} is the temperature at 50% weight loss, T_{max} is the temperature at maximum degradation, W500 is the residue weight % at 500°C.