

Supplementary Materials

Table S1: PAT content of AJC samples from different processing points.

Sampling points	PAT content (Mean \pm SD, $\mu\text{g}/\text{kg}$)		
	First sampling	Second sampling	Third sampling
Receiving of raw apples (RRA)	13.89 \pm 0.74 a	66.34 \pm 2.95 a	28.64 \pm 0.33 a
Sorting of raw apples (SRA)	3.97 \pm 0.28 e	23.37 \pm 1.45 c	10.30 \pm 0.56 e
Belt-type pressing (BTP)	7.99 \pm 0.37 c	27.14 \pm 1.33 b	15.45 \pm 0.80 c
Cloudy apple juice (CAJ)	2.67 \pm 0.38 f	8.32 \pm 0.21 e	10.34 \pm 0.40 e
Pasteurization (PAS)	2.46 \pm 0.19 f	6.49 \pm 0.40 f	7.41 \pm 0.16 f
Enzymatic digestion (ED)	8.69 \pm 0.25 b	23.58 \pm 0.97 c	19.29 \pm 0.92 b
Ultrafiltration (UF)	7.25 \pm 0.31 d	12.01 \pm 0.74 d	12.84 \pm 0.92 d
Pre-clear juice (PCJ)	6.69 \pm 0.37 d	10.49 \pm 0.92 d	11.68 \pm 0.93 d
Adsorption (AD)	0.61 \pm 0.02 g	1.67 \pm 0.21 h	6.09 \pm 0.21 g
Rear-clear juice (RCJ)	/	0.53 \pm 0.04 h	4.85 \pm 0.57 h
Concentrate (CONC)	/	1.27 \pm 0.04 h	8.35 \pm 0.39 f
Finished juice (FJ)	/	3.43 \pm 0.29 g	10.56 \pm 0.52 be
Aseptic filling (AF)	/	1.62 \pm 0.12 h	7.54 \pm 0.79 cf

Note: Values with different superscript letters indicate significant difference at $P < 0.05$ in one column.

Table S2: Hazard analysis for apple juice concentrate.

Samples points	Hazard factors	Prevention and control measures
Receiving of raw apples	Biological: Pathogenic bacteria contamination Chemistry: 1. Pesticide residues; 2. Heavy metal (lead and total arsenic); 3. Patulin Physical: fragments, dirt, gravel and other impurities	Sterilization control through the back 1. Before harvesting the raw materials, the pesticide residues and heavy metal (lead and total arsenic) residues are tested for each batch. 2. Microbiological testing 3. Control the bad fruit rate within 5%. Controlled by floating water conveying process.
Receiving of auxiliary materials	Biological: None Chemical: Heavy metal (lead and total arsenic) residues exceed the standard Physical: None	Evaluation of supplier qualifications, every six months by the supplier to provide product compliance report, do not meet the rejection.
Receiving of package materials	Biological: None Chemistry: None Physical: None	

Washing and floating transportation	Biological: Pathogenic bacteria contamination	<ol style="list-style-type: none"> 1. Regular testing of water quality to ensure compliance with <i>Standards for Drinking Water Qual</i> (2006) requirements. 2. Control equipment hygiene through operational pre-requisite program (OPRP).
Spraying and lifting	<p>Chemistry: None</p> <p>Physical: metal fragments, dirt, gravel and other impurities</p> <p>Biological: Pathogenic bacteria contamination</p>	<p>Strictly implement the operation procedures of fruit washing process</p> <ol style="list-style-type: none"> 1. Regular testing of water quality to ensure compliance with <i>Standards for drinking water quality</i> (2006) requirements. 2. Control equipment hygiene through OPRP.
Sorting of raw apples	<p>Chemistry: None</p> <p>Physical: Metal fragments or parts</p> <p>Biological: Pathogenic bacteria contamination</p> <p>Chemistry: Patulin</p> <p>Physical: None</p>	<p>Strict maintenance plan is implemented, inspection is carried out every 4 hours during the production process, abnormalities are immediately stopped</p> <ol style="list-style-type: none"> 1. Regular testing of water quality to ensure compliance with <i>Standards for Drinking Water Qual</i> requirements. 2. Control equipment hygiene through OPRP. <p>The decay rate is within 3%.</p>
Apple crushing	Biological: Pathogenic bacteria contamination	Control of equipment hygiene through OPRP.

	Chemistry: None	
	Physical: Metal fragments or parts	Strict maintenance plan is implemented, inspection is carried out every 4 hours during the production process, abnormalities are immediately stopped
Collecting of raw juice	Biological: Pathogenic bacteria contamination	1. Regular testing of water quality to ensure compliance with <i>Standards for drinking water quality</i> (2006) requirements. 2. Control equipment hygiene through OPRP.
	Chemistry: None	
	Physical: Metal fragments or parts	Strict maintenance plan is implemented, inspection is carried out every 4 hours during the production process, abnormalities are immediately stopped
Pasteurization	Biological: Pathogenic bacteria contamination	Strict control of sterilization temperature and time
Enzymatic digestion	Biological: Pathogenic bacteria contamination	Control of equipment hygiene through OPRP.
Concentration	Chemical: Heavy metal (lead and total arsenic)	Evaluation of supplier qualifications, every six months by the supplier to provide product compliance report, do not meet the rejection.
	Physical: None	
	Physical: None	
Ultrafiltration	Biological: Pathogenic bacteria contamination	Control of equipment hygiene through OPRP.
	Chemistry: None	

	Physical: None	
Adsorption	Biological: Pathogenic bacteria contamination Chemistry: Patulin	Control of equipment hygiene through OPRP. Control by replacing or cleaning the core material
	Physical: None	
Concentration	Biological: None Chemistry: None	Control of equipment hygiene through OPRP.
	Physical: None	
Aseptic filling	Biological: Pathogenic bacteria contamination Chemistry: None	Strict control of filling room temperature
	Physical: None	
Labeling and Barrels sealing	Biological: Organisms: pests, rodents Chemistry: None	Control of equipment hygiene through OPRP.
	Physical: None	
Storage or Transportation	Biological: None Chemistry: None	
	Physical: None	

Abbreviation: OPRP, operational pre-requisite program.