Analysis of Residual Smoke Consumption of Cigarette Units based on Big Data

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Abstract: Residual smoke refers to the residual cigarettes and cigarette strips produced in the production process of cigarettes. The less the amount of residual smoke is generated, the better is the production. This paper analyzes the main key points of residual smoke output, and then proposes improvement measures, so that the unit can produce less residual smoke.

1. Introduction

In recent years, the tobacco industry is facing four major problems of declining growth rate, increasing industrial and commercial inventories, narrowing structural space, and approaching the inflection point of demand[1]. Facing the concept of tobacco enterprises and big data analysis in the new situation, the lean management cost reduction and efficiency increase are implemented into all aspects of the production and operation of the enterprise, so that the efficiency of the enterprise has been significantly improved[2].

2. Current Situation

Residual cigarettes refer to residual cigarettes and cigarette strips produced in the production process of cigarettes[3]. The consumption level of the single box of residual smoke can intuitively reflect the control ability of the consumption of auxiliary materials in the packaging workshop, and indirectly reflect the production organization ability, process control ability and equipment operation status of the packaging workshop. Reducing the consumption level of a single box of residual cigarettes can make the material consumption reduction index (coil paper, mouth stick, water pine paper, trademark paper, etc.) in the rolling workshop be unified, effective and reasonable.

Table 1 Residual Smoke Consumption Statistics.

Machine number	Output (box)	Residual smoke	Average (kg/box)
1#machine	29000	18500	0.64
2#machine	15000	10470	0.68
3#machine	12000	8128	0.68
4#machine	13500	9388	0.68
5#machine	34400	22635	0.66
6#machine	32900	21973	0.67
7#machine	31200	20843	0.67
8#machine	29500	20000	0.67
Average (kg/box)	197500	131930	0.668

It can be seen from table 1 that the average consumption of residual smoke is 0.668Kg/box, which exceeds the benchmarking index of residual smoke consumption of 0.118Kg/box, and the high consumption of single box of residual smoke is an urgent problem to be solved.

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3. Reason Analysis

The consumption of the cigarette unit residual cigarette single box is divided into teams and sub-machines, as noted in Table 2.

Table 2 Consumption of Single Boxes of Residual Cigarettes.

Date	Group	Consumption of single box of residual smoke per machine (kg/box)							
		1#ZJ19	2#ZJ19	3#ZJ19	4#ZJ19	5#ZJ19	6#ZJ19	7#ZJ19	8#ZJ19
January 4	Group A	0.571	0.579	0.588	0.579	0.579	0.59	0.575	0.577
January 5	Group B	0.566	0.566	0.566	0.507	0.566	0.561	0.573	0.558
January 6	Group C	0.408	0.563	0.568	0.467	0.563	0.56	0.579	0.562
January 7	Group A	0.541	0.464	0.56	0.567	0.564	0.563	0.564	0.563
January 8	Group B	0.599	0.415	0.569	0.579	0.498	0.561	0.565	0.564
January 9	Group C	0.573	0.562	0.572	0.569	0.562	0.588	0.559	0.559
January 10	Group A	0.562	0.567	0.578	0.548	0.567	0.576	0.565	0.527
January 11	Group B	0.561	0.577	0.558	0.586	0.577	0.561	0.563	0.477
January 12	Group C	0.577	0.569	0.384	0.56	0.541	0.552	0.544	0.577
January 13	Group A	0.569	0.601	0.582	0.568	0.602	0.559	0.487	0.569
January 14	Group B	0.571	0.587	0.572	0.577	0.573	0.572	0.552	0.571
January 15	Group C	0.573	0.579	0.561	0.568	0.562	0.578	0.577	0.568
January 16	Group A	0.579	0.576	0.56	0.582	0.561	0.558	0.577	0.586
January 17	Group B	0.573	0.591	0.573	0.562	0.577	0.561	0.571	0.568
January 18	Group C	0.561	0.562	0.561	0.564	0.568	0.568	0.577	0.564
January 19	Group A	0.563	0.585	0.561	0.568	0.582	0.502	0.569	0.562
January 20	Group B	0.564	0.567	0.568	0.564	0.562	0.561	0.569	0.57
January 21	Group C	0.565	0.569	0.572	0.562	0.564	0.571	0.561	0.581
January 22	Group A	0.557	0.579	0.58	0.57	0.579	0.551	0.558	0.567
January 23	Group B	0.581	0.561	0.571	0.581	0.537	0.499	0.569	0.56
January 24	Group C	0.562	0.568	0.551	0.567	0.469	0.572	0.571	0.568
Average (kg/box)		0.561	0.561	0.559	0.560	0.562	0.560	0.563	0.561

As shown in the table:

The maximum consumption of the cigarette unit residual cigarette single box is 0.602kg/box, and the minimum value is 0.384kg/box; The average value is 0.561kg/carton.

The fluctuation of the moving range pattern is large, indicating that the residual smoke consumption control of the cigarette unit is unstable and the control is not accurate enough.

According to the type of shutdown and the site situation, the residual smoke is classified and sorted, and the statisti·cs are shown in Table 3.

Table 3 Statistical Table of Consumption Classification of Single Box of Residual Smoke.

Output	Residual smoke generation	Residual smoke (Kg)	Residual smoke consumption (kg/box)	Accumulation of unit consumption (kg/box)	Percentage (%)	Percentage sum(%)
8500 boxes	Residual smoke from the shutdown of the running strip	2406	0.283	0.283	50.4	50.4
	Residual smoke from large-flow stacks of garbled smoke	943	0.111	0.394	19.8	70.2
	Residual smoke from the partial shutdown of the paper supply	425	0.050	0.444	8.9	79.1
	Residual smoke from wire shutdown	331	0.039	0.483	7	86.1
	Residual smoke from partial shutdown of the mouth	238	0.028	0.511	5	91.1
	Residual smoke from water supply pine paper shutdown	213	0.025	0.536	4.4	95.5
	Downtime due to quality rejection	170	0.020	0.556	3.6	99.1
	Others	94	0.005	0.561	0.9	100

It can be seen from the table that the amount of residual smoke generated by the shutdown of the running strip and the residual smoke generated by the large-flow stacked garbage smoke are the most prominent, accounting for 70.2% of the total residual smoke.

According to the reasons of the running strip, the residual smoke generated by the running strip shutdown was further stratified, and the results of the statistics were shown in Table 4.

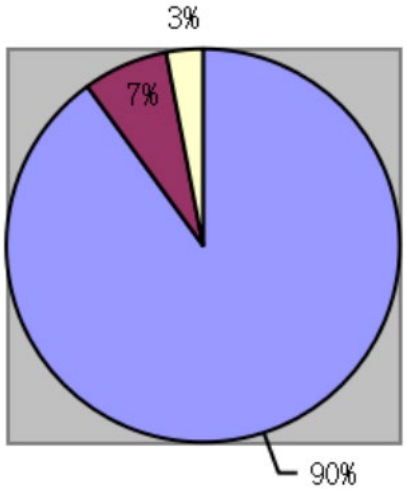
Table 4 Hierarchical statistical table of residual smoke when the running strip shuts down.

Output	Reasons of running strip	Residual smoke(Kg)	Residual smoke consumption (kg/box)	Accumulation of unit consumption (kg/box)	Percentage (%)	Percentage sum(%)
6000 boxes	Temperature runaway of soldering iron	1038	0.173	0.173	61.1	61.1
	Insufficient glue supply	126	0.025	0.198	9.0	70.1
	Instability of steel wire supply	120	0.024	0.222	8.4	78.5
	Improper adjustment of the forming site	96	0.019	0.241	6.7	85.2
	Improper adjustment of the knife head	84	0.014	0.256	5	90.2
	Improper adjustmentof the running strip detector	72	0.012	0.268	4.4	94.6
	Mechanical misalignment	54	0.009	0.277	3.6	98.2
	Other	30	0.005	0.282	1.8	100

As can be seen from the table, the residual smoke caused by the loss of control of the temperature of the cigarette machine soldering iron caused by the shutdown of the running strip reached 0.173 kg/box, accounting for 61.1% of the residual smoke generated by the shutdown of the cigarette unit running strip, which shows that the temperature control of the cigarette machine soldering iron is the main reason for the large amount of residual smoke produced by the shutdown of the cigarette unit running strip.

The large-flow stacked smoke is hierarchically counted according to the chronological order of smoke generation, and the results of the statistics are shown in Table 5.

Table 5 Hierarchical Statistical Table of Large-flow Stacking Smoke.

Output	Description of the smoke's situation	Residual smoke	Residual smoke consumption	Proportion	Pie chart analysis
5800 boxes	Smoke creaked when the machine starts and stops	581Kg	0.100Kg/ box	90%	
	Smoke produced during machine quality rejection	46Kg	0.008Kg/ box	7%	
	Smoke produced during machine normal production	18Kg	0.003Kg/ box	3%	
	Total	645Kg	0.111Kg/ box	100%	

From the statistical results, it can be seen that the residual smoke generated by the large-flow stacking smoke reaches 0.100kg/box when the machine starts and stops , accounting for 90% of the residual smoke of the large-flow stacking code, which shows that the large-flow stacking gas produced when the machine starts and stops is the crux of the large amount of residual smoke generated by the large-flow stacking.

Through the above survey, it can be seen that the main reasons for the large consumption of residual cigarette single boxes in the ZJ19 cigarette unit are:

The temperature of the cigarette machine soldering iron is out of control, causing the running strip to stop;

Large-flow stacking of garbled smoke when machine starts and stops.

4. Resolution

In view of the suspension of the running strip caused by the temperature of the cigarette machine soldering iron, the measures taken are: the external connection type is changed to the interpolated type, fixed with silicone, played on the soldering iron body, the temperature measuring element is inserted into the soldering iron body, and the temperature measuring element is connected with the soldering iron.

Table 6 Table for temperature test of new temperature measurement elements.

The running environment	Temperature-controlled meter readings T(℃)	Theoretical calculation of the temperature value P		Handheld high-precision thermostat reading S	
		P=(R-100)÷0.39	△P=T-P	S	△S=T-S
Start	280	277(R=208Ω)	3	285	-5
	255	254(R=199Ω)	1	260	-5
	260	260(R=201Ω)	0	254	-6
Process	280	279(R=209Ω)	1	279	0
	275	274(R=207Ω)	1	274	0
	278	277(R=208Ω)	1	276	1
Shutdown	272	275(R=109Ω)	-3	278	-6
	255	258(R=109Ω)	-3	260	-5
	260	261(R=109Ω)	-1	263	-3
Stoppage	156	154(R=160Ω)	2	155	-1
	183	182(R=171Ω)	1	181	2
	260	259(R=201Ω)	1	261	-1

In view of the large flow stack of garbled smoke when starting and stopping, the measures taken are: a high temperature alarm delay shutdown program is designed and put it into operation. A

self-written control program is used to add delay function. The redundant nodes of the SIEMENS LOGO logic module of the "ZJ19 Unit Adapter Cutter Lubrication" project is exploited to edit the SIEMENS LOGO program to achieve the delay function. The maintenance time at the end of the month in August is used and the signal is connected to the SIEMENS LOGO logic module.

Add smoke layer detection switch. Install a smoke layer detection switch at the entrance of the large flow, when the smoke layer is detected, the inverter is turned on. In other cases, and the inverter is turned off to ensure that the smoke layer will not sink too much.

5. Effect Verification

5.1 Target completion

The average residual smoke of cigarette units in the three months after the implementation of the measures was 0.398kg/box. The consumption data of the cigarette unit residual cigarette single box is between 0.377kg/box and 0.419kg/box. The moving range curve is more stable, and the average moving range is reduced from 0.0219kg/box before the activity to 0.0079kg/box after the activity, indicating that the accuracy of the consumption control of the single box of residual cigarettes of the cigarette unit has been strengthened and improved.

5.2 Economic benefits

5.2.1 The direct economic benefits are

$\triangle S1=D\times\triangle Q\times C=(185000\times0.561)\times(0.561-0.398)/0.561\times(114/44)=78128$ RMB

5.2.2 The savings in retrofit costs are

$\triangle S2=M1-M2=8\times110000-8\times600=795200$ RMB

5.2.3 The economic benefits generated by QC activities are

$\triangle S=\triangle S1+\triangle S2=78128+795200=873328$ RMB

5.3 Other benefits

Based on big data analysis, the consumption of single boxes of residual cigarettes in cigarette units has been significantly reduced, which has promoted cost savings and consumption reduction, provided scientific value for industry promotion and application, and demonstrated the team's innovation ability.

References

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