

PHARMACEUTICAL AND ANALYTICAL STUDY OF GANDHAK MARIT TAMRA  
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## ABSTRACT

**Introduction:** Tamra Bhasma is copper based Ayurvedic medicine, used for the treatment of various diseases. Tamra is converted into bhasma by a process called marana, which not only removes the unwanted properties but also induces desirable properties. Now a day, due to increasing demand of Ayurvedic medicines, various companies have started preparing bhasma on large scale. Though several methods of preparation of Tamra Bhasma are found in Rasashastra classics, several difficulties occur during the preparation of a good-quality Bhasma. It is claimed that if bhasma is not prepared as perclassical text, deposition of administered bhasma may lead to serious consequences. Thus, it is essential to prepare the bhasma as per classical references. **Aims and Objectives:** 1. to study the process of Tamra Maran by using Ghandak as intermediary media. 2. To analyze the constituents of Tamra Bhasma. **Materials and Methods:** A] Pharmaceutical study- TB was prepared as per the classical guidelines. B] Analytical study- TB was subjected to various analytical tests like loss on drying, loss on ignition, X-ray Diffraction, etc. **Results:** Copper % was approximately 62% in Gandhak maarit Tamra Bhasma. Copper was present in sulphide form. **Conclusion:** Tamra bhasma can be prepared easily and quickly by using Gandhak as an intermediary media.

**KEYWORDS:** Maran, Tamra, Tamra Bhasma, X-ray diffraction.

## INTRODUCTION

A careful survey of the original texts on Rasashastra shows that the subject covers the entire field of inorganic pharmaceutical preparations like metallic, non-metallic compound of Ayurvedic material medica. These Rasasadhis are appreciated for their smaller dosages, quicker effectiveness, long durability etc.<sup>[1]</sup> Thus the Rasasadh preparation plays an important and major role in curing the human beings. Dhatu bhasma readily mix with the first of the saptadhatu and can be easily circulated in the body.<sup>[2]</sup> Proper and careful use of bhasma can even cure the dreadful diseases i.e. Maha Amaya.<sup>[3]</sup> So bhasma plays an important and vital role in Ayurveda.

## AIMS AND OBJECTIVES

- To study the process of *Tamra Maran* by using *Gandhak* as intermidery media.
- To analyze the constituents of *Tamra Bhasma* prepared by using *Gandhak* as intermidery media.

## MATERIALS AND METHODS

- 1) **Pharmaceutical Study**
- 2) **Analytical Study**

1) **Pharmaceutical Study**

A] Collection of Raw material:

- 1) Collection of Tamra
- 2) Collection of Parad
- 3) Collection of Gandhak
- 4) Collection of other shodhan, maran and bhavana dravya

B] Preparation of Kanji

C] Preparation of Kulattha Kwatha

D] Shodhan of Drugs

- 1) Shodhan of Tamra
    - a) Samanya Shodhan
    - b) Vishesh Shodhan
  - 2) Shodhan of Gandhak
- E] Maran of Tamra

A] **Collection of Raw material:** from the local market.

**B] Preparation of Kanji**

Reference<sup>[4]</sup> - Sharangdhar Samhita Madhyam  
Khanda 10/14

Type of Procedure - Fermentation

Purpose - Samanya Shodhan of Tamra

**C] Preparation of Kulattha Kwatha**

Reference<sup>[5]</sup> - Sharangadhara Samhita  
Madhyama Khanda 2/1

Type of Procedure - Kwatha (boiling)

Purpose - Samanya shodhan of Tamra

**D) Shodhan of Drugs**

**a) Samanya Shodhana of Tamra**

Reference<sup>[6]</sup> - R. R. S. 5/29

Type of

Procedure - Nirvapa (heating and quenching)

Purpose - For removing the impurities

Media - Tila Taila, Takra, Gomutra, Kanji,  
Kulattha kwatha

Ingredients - Raw Tamra – 250 gm

Media - Amount of liquid sufficient to quench  
the Tamra properly and completely.

**Results**

Samples	A	B	C
Initial weight	300 gm	300 gm	300 gm
Final weight	287.7 gm	278 gm	281.6 gm
Weight loss	12.3 gm	22 gm	18.4 gm

**b) Vishesha Shodhana of Tamra**

Reference<sup>[7]</sup> - R.R.S. 5/51

Type of Procedure - Nirvapa

Purpose - preparation of Tamra for  
Marana

Ingredients - Samanya

Shodita Tamra – 275gm

Saindhav – 150 gm

Nimbu Swarasa – 75 ml

Nirgundi Swarasa – q. s.

**Results**

Samples	A	B	C
Initial weight	275 gm	275 gm	275 gm
Final weight	262.7 gm	259.3 gm	254 gm
Weight loss	12.3 gm	15.7 gm	21 gm

**c) GandhakShodhan**

Type of Procedure - Dhalan

Reference<sup>[8]</sup> - R.T. 8/7-11

Equipments - Weighing machine, iron pan,  
Stainless steel vessel, gas,  
cloth, etc

**Ingredients**

AshuddhaGandhak - 1000 gm

Gogrit - 250 gm

Godugdha - Q. S.

**Results**

Samples	A	B	C
Initial weight	1000 gm	1000 gm	1000 gm
Final weight	957 gm	961 gm	952 gm
Weight loss	43 gm	39 gm	48 gm

**E] Maranof Tamra**

**Gandhak Marit Tamra Bhasm**

Reference<sup>[9]</sup> - R.T. 17/26-29

Type of procedure - Putapaka

Drug for Incineration - Gandhak

Groups - Three batches viz;

- GMTB1
- GMTB2
- GMTB3

**Ingredients**

Shuddha Tamra - 100 gms

Gandhak - 200 gms

**Procedure**

Shuddha Tamra and shuddha Gandhak were taken in khalvayantra and were triturated. The mixture thus prepared was spread in the *sharava* (earthen vessel) and another *sharava* was covered over it. *Matakapad* was done in 3-7 layers. *Sharavasamputa* thus prepared was dried in shade. The dried *sharavasamputa* was then kept in *valukayantra* and subjected to heat for 24 hrs. *Pachan* was done on *mandagni* for 24 hrs. Then it was allowed to cool. This *Pachit Tamra* powder thus obtained and *shudha gandhak* were taken in equal quantity and triturated again. *Sharavasamputa* was done and subjected to *puta*.

**2) Analytical Study**

**Ayurvedic Parameters:**<sup>[10, 11, 12]</sup>

1. Rekhapurna – fills the spaces in between finger lines
2. Varitar – floats on the surface of water
3. Nirdhum – burns without smoke
4. Nishchandra – without metallic luster
5. Unnam – grains of rice floats on the surface of *bhasma* which floats on water
6. Sookshma – very fine
7. Laghu – light
8. Avami – doesn't produce nausea
9. Amlapariksha – curd test

**Physicochemical Study**<sup>[13]</sup>

1. Description
2. Identification / Detection of Elements / Qualitative tests
3. Solubility
4. pH (1%, 10% filtered solution)
5. Conductivity (1%, 10% filtered solution)
6. Loss on Drying at 105°C
7. Loss on Ignition
8. Elemental Assay for S, SO<sub>4</sub>, Cu and Hg
9. XRD

## 1. Description

### Description of Gandhak maarit Tamra Bhasma Samples

Sr. No.	Samples	Colour	Odour	Taste	Texture
1	GMTB1	Black	Odourless	Tasteless	Smooth
2	GMTB2	Black	Odourless	Tasteless	Smooth
3	GMTB3	Black	Odourless	Tasteless	Smooth

## 2. Identification / Detection of Elements

### a) Test for Sulphate

About 0.5 gm of sample was taken into test tube and shake well. Then it was centrifuged and upper solution was treated with Barium chloride solution. White precipitate was obtained in all the three samples confirming the presence of sulphate.

### b) Test for Sulphide

About 0.5 gm of sample was taken in the test tube and was treated with dil HCl and little zinc dust. Evolution of the gas which turns lead acetate paper black confirms the presence of sulphide.

### c) Mercury

Filtrate obtained after treatment of the sample with Bromine and Nitric acid was treated with Charcoal. Filtered portion of the filtrate was treated with little aqueous Ammonia. Granular precipitate appeared which showed the presence of mercury in minor quantity.

## 3. Successive Solubility Determination

### a) Solubility in CS<sub>2</sub>

Accurately weighed 500 mg of sample was taken in tarred sintered glass crucible. The crucible was kept in a 100 ml beaker. Ice was taken in 500 ml beaker and 100 ml beaker containing sintered glass crucible was kept in it. 4 to 5 ml of CS<sub>2</sub> was poured in the sintered glass crucible and covered with watch glass. Then it was shaken gently for few minutes and then sucked by filtration pump. It was dried in air and finally in oven at 105°C and weighed. The process was repeated to constant weight.

### b) Solubility in H<sub>2</sub>O

After above operation the crucible was kept again in 100 ml beaker and 20 ml of water was added in the crucible and 10 ml outside the crucible in the beaker. Then it was boiled for 10 minutes and sucked by filtration pump. Finally it was dried at 105°C and weighed. The process was repeated till constant weight.

### c) Solubility in dil. HCl

After determination of solubility in water the crucible was kept in a 100 ml beaker and 10 ml of dil HCl was added in the crucible and 10 ml of water was added to the beaker. Then it was boiled for 10 minutes and sucked by filtration pump. Then dried in oven at 105°C and weighed. The process repeated up to constant weight.

### d) Solubility in dil. Nitric acid

After above operation the crucible was kept in 100 ml beaker and 10 ml of dil Nitric acid was added in the crucible and 10 ml. of water was added to the beaker. Then it was boiled for 10 minutes and sucked by filtration pump. Then dried in oven at 105°C and weighed. The process was repeated up to constant weight.

### e) Solubility in Aquaregia

After determination of solubility in dil Nitric acid the crucible was kept in 100 ml beaker and 5 ml of Aquaregia was added in the crucible and 10 ml. of water was added to the beaker. Then it was boiled for 10 minutes and sucked by filtration pump. Then dried in oven at 105°C and weighed. The process was repeated up to constant weight.

## 4. pH (1%, 10% filtered solution)

0.5 gm and 5 gm of the samples were shaken gently in 40 ml of water for about ½ hour, and then filtered. Thus filtrate of 1% and 10 % suspension was obtained. pH of filtrate was measured by pH meter after calibration of the electrode (Toschon – C154 instrument).

## 5. Conductivity (1%, 10% filtered solution)

0.5 gm and 5 gm of the samples were shaken gently in 40 ml of water for about ½ hour, and then filtered. Thus filtrate of 1% and 10 % suspension was obtained. Conductivity of filtrate was measured by standardized electrode of conductivity meter (Systronic Conductivity Bridge 305).

## 6. Loss on Drying at 105°C

About 1 gm of sample was weighed in LOD crucible and dried at 105°C and thereafter cooled in desiccators. Weighing, drying and cooling were repeated to constant weight. Percentage of Loss on drying was calculated.

## 7. Loss on Ignition

About 1 gm of sample was weighed in tarred silica crucible and heated at temperature not exceeding 450°C, cooled it in desiccators and weighed. Heating and cooling was repeated to constant weight. Percentage of Loss on Ignition with reference to the air dried drug was calculated.

## 8. Elemental Assays

### A) Estimation of Sulphur

Accurately weighed about 500 mg of Bhasma was treated with 3 ml mixture of Bromine in carbon tetra chloride (2:3). After 5 min. 5 ml of Nitric acid was

added to it. Beaker covered with watch glass was allowed to stand for 15-20 min. The covered beaker was then heated to 100°C till cessation of the action, then the cover was slightly displaced and it was heated to dryness. 5 ml of conc. 5 ml HCl was added and heated to dryness in water bath. Then again 5 ml HCl was added and 40 ml warm water was added to it. It was again heated in water bath cooled for 5 min then it was filtered through cotton, rinsing the cover. Supernatant was separated and residue was washed repeatedly and was pooled together with the initial supernatant. Charcoal was added to it and warmed slightly with stopper at the mouth of flask. It was cooled. Then it was filtered and volume was made 100 ml with washings. 50 ml of the clear Blue solution was treated with 5 % Barium Chloride and HCl in excess. It was stirred well. The solution was allowed to stand and ppt obtain was filtered through Whatman number 42 paper and was washed thoroughly to remove Barium chloride. Then filter paper with residue was dried and ignited at 700 to 800°C in tarred Silica crucible to constant weight.

### B) Estimation of Copper

0.4 ml of the solution was taken from the solution left behind in sulphur estimation. 4.1 ml of water was added to it followed by addition of 0.5ml of Ammonia solution (1:1) and its O.D. was measured as 660nm.

1% Copper sulphate solution was used as standard the aliquot of 0.3, 0.4, 0.5, 0.6, 0.7 ml with water to make the volume 4 ml and followed by addition of 0.5ml of Ammonia solution (1:1) using water as blank.

### C) Estimation of Sulphate

About 5 gm each sample was taken. 25 ml water and 0.5 ml HCl was added to it. It was allowed to stand for 5- 10 mins with intermittent shaking. Then it was filtered and the residue was washed several times so that the volume goes to nearby 150-200 ml. Then add conc. HCl 1 ml and 200- 300 mg Alumimium powder. Shake well and then fioter it with washing 45 times. Add 2 ml conc. HCl and 5 % warm Barium chloride sol to the filterate in excess . it was allowed to settle down and clear supernatant was obtained and ppt was obtained. It was then filtered through Whatmaan no. 42 paper and washed thoroughly to remove BaCl<sub>2</sub>. The paper was dried and ignited upto constant weight.

### D) Estimation of Mercury

A Trial of estimation of mercury in Rasa maaritTamraBhasma by H<sub>2</sub>S gas did not leave behind any black ppt. After its treatment with hot dil Nitric acid shows that mercury is not present in sufficient quantity to be estimated in general.

### 9. XRD (X-ray diffraction or crystallography)

X-ray diffraction patterns were obtained using Shimadzu XRD 6000 diffractometer with Cu-KX a target with 40 KV voltage and 30 MA current. The X-ray diffraction of

sample was matched against the standard reference spectra library.

## OBSERVATION AND RESULT

### Pharmaceutical Study

#### Shodhan of Tamra

##### a) Samanya Shodhan

It was done by heating *Tamra* coils red hot and quenching them in *Tila Tail, Takra, Gomutra, Kanji, Kullatha Kwath* seven times in each.

#### Results

Samples	A	B	C
Initial weight	300 gm	300 gm	300 gm
Final weight	287.7 gm	278 gm	281.6 gm
Weight loss	12.3gm	22 gm	18.4 gm

##### b) Vishesh Shodhan

It was done by Tamra coils were levigated with Saindhav and Nimbu swaras paste. Coils were heated and quenched in Nirgundi swarasa 8 times.

#### Results

Samples	A	B	C
Initial weight	275 gm	275 gm	275 gm
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### Shodhan of Gandhak

#### Results

Samples	A	B	C
Initial weight	1000 gm	1000 gm	1000 gm
Final weight	957 gm	961 gm	952 gm
Weight loss	43 gm	39 gm	48 gm

### Maranof Tamra

#### Gandhak Marit Tamra Bhasma

Pachan of shoditTamra was done. Pachittamra and gandhak were triturated and then subjected to puta.

Table .1 Putawise observation of *Gandhak maarit Tamra Bhasm*.<sup>[1]</sup>

Putawise no.	Material added to Sh. Tamra	Colour	Chandrika	Rekhapurnatva	Varitar	Uttam	AmlaPariksha	Wt. obtained (g)	No. of cowdung cakes
1	Equal gandhak	Black	-	+++	+++	++++	+	106	21
2	Equal gandhak	Black	-	++++	++++	++	-	93	21
3	Equal gandhak	Black	-	++++	++++	++	-	86.5	21

Table .2 Putawise observation of *Gandhak maarit Tamra Bhasm*.<sup>[2]</sup>

Putawise no.	Material added to Sh. tamra	Colour	Chandrika	Rekhapurnatva	Varitar	Uttam	AmlaPariksha	Wt. obtained (g)	No. of cowdung cakes
1	Equal gandhak	Black	-	+++	+++	++++	+	113.7	21
2	Equal gandhak	Black	-	++++	++++	++	-	97	21
3	Equal gandhak	Black	-	++++	++++	++	-	83	21

Table .3 Putawise observation of *Gandhak maarit Tamra Bhasm*.<sup>[3]</sup> Analytical Study

Putawise no.	Material added to Sh. tamra	Colour	Chandrika	Rekhapurnatva	Varitar	Uttam	AmlaPariksha	Wt. obtained (g)	No. of cowdung cakes
1	Equal gandhak	Black	-	+++	+++	++++	+	98.3	21
2	Equal gandhak	Black	-	++++	++++	++	-	89	21
3	Equal gandhak	Black	-	++++	++++	++	-	76.7	21

Organoleptic parameters of *Gandhak maarit Tamra Bhasma*

Parameter	GMTB1	GMTB2	GMTB3
A] Shabda Pariksha	No metallic sound when crushed between teeth	No metallic sound when crushed between teeth	No metallic sound when crushed between teeth
B] Sparsha	No coarse particles by touch (Shlakshna)	No coarse particles by touch (Shlakshna)	No coarse particles by touch (Shlakshna)
C] Rupa 1. Colour 2. Susnigdham 3. Nishchandravam	Black Oleated in consistency No metallic lustre	Black Oleated in consistency No metallic lustre	Black Oleated in consistency No metallic lustre
D] Rasa	Tasteless (Niswadu)	Tasteless (Niswadu)	Tasteless (Niswadu)
E] Gandha	No Specific	No Specific	No Specific

## Physiochemical Study

## Description

Sr. No.	Samples	Colour	Odour	Taste	Texture
1	GMTB1	Black	Odourless	Tasteless	Smooth
2	GMTB2	Black	Odourless	Tasteless	Smooth
3	GMTB3	Black	Odourless	Tasteless	Smooth

## Results

Sr. no.	Analytical Tests	GMTB1	GMTB2	GMTB3
1.	<b>Solubility</b>			
	<b>CS<sub>2</sub></b>	4.20% w/w	4.60% w/w	4.00% w/w
	<b>H<sub>2</sub>O</b>	2.80% w/w	3.00% w/w	4.00% w/w
	<b>HCl</b>	2.60% w/w	3.40% w/w	2.40% w/w
	<b>HNO<sub>3</sub></b>	85.50% w/w	83.40% w/w	85.60% w/w
	<b>Aquregia</b>	2.60% w/w	3.20% w/w	3.14% w/w
2.	<b>pH</b>			
	<b>1% solution</b>	4.43% w/w	4.52% w/w	4.77% w/w
	<b>10% solution</b>	3.57% w/w	3.67% w/w	3.91% w/w
3.	<b>Conductivity</b>			
	<b>1% solution</b>	0.55x 10 <sup>4</sup> μmhos	0.55 x 10 <sup>4</sup> μmhos	0.55 x 10 <sup>4</sup>
	<b>10% solution</b>	2.3 x 10 <sup>4</sup> μmhos	3.5 x 10 <sup>4</sup> μmhos	2.8 x 10 <sup>4</sup> μmhos
4.	<b>Loss on drying</b>	2.10% w/w	4.18% w/w	1.71% w/w
5.	<b>Loss on Ignition</b>	6.90 % w/w	-5.82 % w/w	14.61 % w/w
6.	<b>Elemental Assay</b>			
	<b>Estimation of S</b>	28.150% w/w	28.007% w/w	28.004% w/w
	<b>Estimation of Cu</b>	61.53% w/w	61.53% w/w	57.75% w/w
	<b>Estimation of SO<sub>4</sub></b>	0.5880% w/w	0.7584% w/w	0.5698% w/w

## Identification

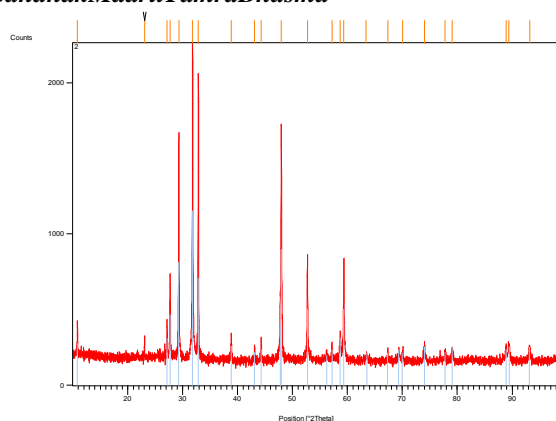
## Qualitative analysis

Elements	Observation and Results
Sulphate (SO <sub>4</sub> <sup>2-</sup> )	Present
Sulphide (S <sup>2-</sup> )	Present

## XRD

In graphs the sharp peaks represent the crystalline structure while the base represents the amorphous forms of Bhasma.

## GandhakMaaritTamraBhasma



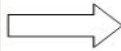
Visible	Ref. Code	Score	Compound Name	Displacement [°2Th.]	Scale Factor	Chemical Formula
*	01-074-1234	85	Covellite	0.000	1.084	Cu <sub>4</sub> ( S <sub>2</sub> ) <sub>2</sub> ( Cu S ) <sub>2</sub>
*	00-003-0724	33	Covellite	0.000	0.163	Cu S

# PHARMACEUTICAL STUDY

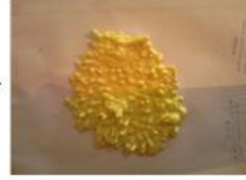
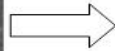
## GANDHAK SHODHAN:



ASHUDHA GANDHAK



DHALAN OF GANDHAK  
IN GODUGDHA



SHUDHA GANDHAK SLAB

## TAMRA SHODHAN:



ASUDHA TAMRA



NIRVAPAN OF TAMRA



SHUDHA TAMRA

## TAMRA MARAN

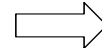
### GANDHAK MAARIT TAMRA BHASMA:



SHUDHA GANDHAK+  
SHUDHA TAMRA



SHARAV SAMPUTA



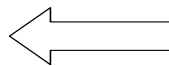
VALUKAYANTRA PACHAN



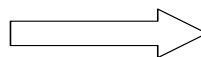
PUTTA



PUTTA



PACHIT TAMRA



GANDHAK MARIT TAMRA BHASMA

# ANALYTICAL STUDY

## AYURVEDIC PARAMETERS:



**VIRITAR**



**UTTAM**



**REKHAPURNA**



**NIRDHUM**



**AMLAPARIHSHA**

## MODERN PARAMETERS:



**L.O.D**



**L.O.I**



**SOLUBILITY**



**pH**



**ASSAY FOR SULPHUR**



**ASSAY FOR SULPHUR**



**ASSAY FOR Cu**



**ASSAY FOR SO<sub>4</sub>**

## DISCUSSION

### Gandhak maarit bhasma

- Pachan of tamra was done in valukayantra with double quantity of gandhak for 24 hrs. As the temperature is not mentioned specifically in rasashastra classics, pachan was done on mandagni. Then after it was subjected to puta. A thin silver coating was seen on the surface of the tamrabhasma. It disappeared after it was triturated. This silver coating might have been formed as a result of formation of some unstable compounds which immediately disappeared after trituration. The no. of puta required was less.

Following points can be considered while using *Gandhak* as intermediary media:

- The Marana process of Lauha with Gandhakadi media is considered as a Kanistha or inferior quality.<sup>[14]</sup> There are different opinions regarding the word Gandhakadi. Some research scholars

commented Gandhakadi as only sulphur, but most of the research scholars consider sulphur and other minerals also. It is narrated in the Rasendrasara Sangraha and Ayurveda Prakasha that Gandhakadi covers all the minerals except mercury (Parada).

- Marana with the Gandhaka media is an easier and also quick process. In Rasarnava it is narrated that
- “There is no such metallic elephant which cannot be killed by the lion sulphur”.
- The metallic Bhasma prepared with Gandhakadi media may contain sulphur in sulphide form, which may enhance the absorption of the drug in the body and also produce ill effects.
- Sulphur containing Bhasma cannot be prescribed in all the conditions because of its Tikshna, Ushna properties.
- Due to these above mentioned effects Lauha Marana by Gandhakadi media can be considered as a Kanistha i.e. inferior in quality.



**CONCLUSION**

The following conclusions were made on the basis of observations and results obtained

- The adopted method for preparation of TB can be considered as easy and convenient.
- TB should be considered as combination of copper and sulphur in CuS form.
- Sulphur % was approximately 62% in Gandhak maarit bhasma.
- The adopted method for the preparation of gandhak maarit tamra bhasma requires less number of puta.
- The adopted method for preparation of TB can be considered cost effective.
- Gandhak maarit Tamra Bhasma can be prepared in relatively less duration.
- Gandhak maarit tamra bhasma is recommended for external use and not for internal use in classics. But to prove this further *Clinical trials* are very essential in this respect.

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