





# 

\* C <sup>1</sup>/<sub>1</sub> at . *E*- : (L.C.).

R 1 2 O t 2022; R 7 7 D 2022; A t 27 D 2022 A a a 30 D 2022 0048-9697/ 2023 E B.V. A t t

### 1. Introduction

# (HJ 1089–2020) a E

a att



2. Methods and data



2.1. E

2.1.1. 2.1.1. T VOC 1, t t t C a t 1 2010–2019 t at a 1 at t .T t a-t , t 1 a, t , a a a a at a t t t t t a , a , t , a tt fl . T VOC 1 a at a :

$$E = A \times EF \times (1 - \zeta \times \eta \times \theta) \tag{1}$$



Fig. 1. T t a tail a a tail a d Tail VOC 11 t 1 t 1 t .

aĴ ť. ata at¶ ,t а VOC t t at a t <u>a</u> , a at a construction of the second s t VOC t а al a taln a l Itl Ί ta af а Т a a' t 2017 (M ta., 2021),t , a tath at 2018–2019 a 10% 2015–2017 t, 5%. tt t, t filt at a at-tat, tallt, a, a , tatt a a t t А 4.3 % 1 t a a fi а а t ¶t t at t M ,t a. (2021), . ., 2013, 2014–2017, a 2018–2019, a (0.5 %), at (2 %), a at (10 % at (2%), a at (10%)



a at t t ta, the constant of the tangent that the tangent the tangent tangent

$$E_{i,k} = \Sigma_k E_i \times R_{i,k} \tag{2}$$

T OFPEI a at t OFP 11 1 t t a at t t a (La ta., 2020). W a at t OFPEI a a :

$$OFPEI_i = \Sigma_k R_{i,k} \times MI_{\mathbf{k}^k}$$
(3)

A OFP-a VOC 111 t, t 1t1 t a a t at VOC 111 t a MIRa. It a a at a :

$$OFP_i = \Sigma_k E_{i,k} \times MI_{\mathbf{k}^k}$$
(4)



## 2.2. A (AD)





$$EF_{,} = \frac{\Sigma E_{,}}{\sum C_{,I} - A} = \frac{\Sigma C_{,} \times .}{\sum C_{,I} - A}$$
(5)

t a tat ta / a fl, T EF t-a a -VOC-a a a a t a tat t t t t a T a tat t t t (2019).F ,t EF t-a a a a t 15t tat t a at-a a , a a vOC 1 t"7 ju , t La ta. 1 a t









Ε



Fig. 4. T VOÇ İtla İta ta İtla İta ta a a İtla ta S4 a İtla ta a a İtla ta S7 İtla İ t-a

. L

.

.Sla S2a tt a ta 17 , tl ;S5a S6a tt a ta '¶'¶ a

ati a 45.5-69.8%. T aatiti, t VOC ia a at a t , t , ti ti a, t at t t C a, t , ti ti a, OVOC a i ta i , t ti aa a . At t ti i a a, a at t a, t, OVOC a, a a ti t, a, i a t a, i ti a i , t t a, t, a, a a i t, ta i , a a t , a t, a a i t, ta i , b at at, a a d t a ti a i , b at a a a (8.6%). I ta ,1,3- ta , a t t t t t , t t a t 35.3% a VOC.

T aațiti a ata t a ț t t

a ti 55.3% a 54.6% a VOC, ti .F at-a (..., S12), t, ti ti, a a , a ai a , a OVOC i a, a ti 36.8%, 34.2%, a 28.9% t t ta, ti .T a a ai t at-a i t, a t t a, ai, t ta, at t a , t.A ai a OVOC ai i at a , ai t at i ti, , it t a a , a t .A , ai t a VOC t (..., S13), a ti 93.0% a VOC .T at a ai t - a a a t 92.0% a VOC.

3.2.2.C fi I, t' t tat t fi t f I t' t, a VOC fi ata t (Ta, S4) t t I t' C'a a a tat t at a a at a .

Ε



Gravure printing Lithography letterpress printing Stencil printing and others Compounding

Fig. 6. A a VOC 11 t 1 t 2010t 2019 C1 a.

a 1 656.4 G 7 2010,7 t t ţĮ t 916.1 G 7 2019. VOC 2010 t 2018, а a 2018 at 939.8 G ą, а t tat t at ta tla а t т íl а а а t Į, 71 VOC t t at.t t t at t 4.7 % 2017 2017 t 0.7 % at 2017 a 2019 (-2.5%), а a ' а Ί 2018, a at а 们们 (F . 2). F t<sup>a</sup> t t а a a t t ή Ĥ .S6, a a t 2010 t t tta VOC 2019, a . Lt 42.3 .∠.3 ,<sup>tt</sup> t t -46.7 4 аĺ 33.2 %-41.2 %, . L/t . 5.5 %–7.9 %, а %t l 8.0 %-10.6 % a t 们们 (<3%). St La Ja V aа t-a а , a а ta t а ť! Ί .F ttla t VOC а Тa t t-a а at а а t t t







3.4.

OFP

竹竹 voç 'lat А t . A, Ĥ . S7,t t, 2019 аа t,a 竹前 a t VOC t a OVOC, 竹竹 44.9 % a VOC a t a a 44.9 % at (18.6 %), a /a (5.8%), a 1 at, t at OVOC a, a 1 t t t t t (22.6 %), a (5.0 %), a 7 a t (3.1 %). T ta t 1 tata. . Et t (12.5 %), a (8.0%) fi VOC a tat (28.9%),t t a (7.6,%),,a - ta (2 t) t,t t - ta (2.4%) t t fi VOC ίĮ. 59.4 % a YOC '**f**' <sup>a</sup> Ft a tat,t а а at 🦷 ų. 4 t 1 la . OVOC , a ή а Ίa t  $\eta_t$ а tt t 1 a t al а 首角 voc 1 , at 1a а a t а s f 3.3. T 3.2 a а VOC S5. ti ti ti Ciaa Т OEPEI VOC 1 1.4t 2.7 O<sub>3</sub>/ VOC . L tt -. S8, а а t OFPEI (2.7 O<sub>3</sub>/ ), а а t

a 1/-(2.6 O<sub>3</sub>/ ), t  $(1.6 O_3/, ), a$ a t, , a t , t a а a t , a ť! 57.1 %, 45.3 %, a 42.9 % , t OFPEI a , t t a at t, a ti s ti .F t at a OVOC,T ht a , OI t ta OFPEI, t t, a at/ 1 t 1 t . C 1 a1 2019 a ,t QFP а OVOC 1 i T t ta OFP VOG t 🕴 . 8 a, t ð 1 1 ťŤ. 1834.5 G . A а 4.5 G.A a OFP a 掅 a 1 Ί .Ga a a ti ti ť¶ t t t tta c. tt/ (7.9%), tt -F .8, t ta OFP (29.9 % t t t a t 53.2 %, а tt (6.2), a t а а t Ίat 1 a at (38.8%) at а (24.8) a OVOC t а /a 1 (20.6 %). T<sup>¶</sup> att tl t t¶ а t <sup>7</sup> OVOC (44.9%) at a t a a (22.6 %) a a at (18.6 %). T at t,†t/ ¶lfiat, а а a a OFP a /a a ∕a I MIR a t t t t (24.9%), t a tat (9.1%), t 1,3- ta , (7.3 %), t fi at , , a t t t t t  $\eta^{1-t}_{t}$ (4.0 %) t ta (5.5%), a t t t.

### 4. Discussions

4.1. C





Fig. 9. Cal VOC 11 Itil t t t t a 1 îlat.

t a. (2018) a , M t a. (2021). T t , t at a , t at a , t at a , t at a , t at a , t at a , t at a , t at a , t at a , t at a , t at a , t at a , t at a , t t (... at /t / a / a... t / EF t ...EF a / t/ /t a  $\begin{array}{c} a \\ 1 \\ t \\ a \\ t \\ \end{array}$ a at ¶i∐a ta. 1.65 <u>V</u>OC <sup>-1</sup>a a 0.01 a a t ¶<sub>tt</sub> t t<sup>1</sup>, <sup>a</sup> Ίt EF.T OC t Ta Th VOC t а t.

4.2. P

A', a , t t t a 't', a t VOC t't' t 'C'a,t t ta 'l a OFP.T , t t' VOC', t 't' 't, 1 a OFP OFP tat tt a ≥80 % t a ti tifia j ta ta a t,, a t.O t t t <u>1 (</u> t ta a at, UV-a 1 t1 , a .St1 t ▶ t . T \_≻ t а a ta t а 1 t a t<sup>¶</sup>tt ⊳t Jt fi'l t t-a Ί , a t t ťľ . Т atat tallti,t VOC 4 竹竹 <sup>1</sup>/τ.τ.γ 1 t 1 a а t t,K<sup>T</sup>t taa.IE t a t y (GB 41616-2022) (M<sup>1</sup> t E t (MEE), 2022) C<sup>1</sup> a, fi<sup>1</sup> at a t t a a t a t a t (NMHC). It t t at fi<sup>1</sup> t E а аt

at¶ ¶t 9 fl 9 t ¶ t t t, (1) t, ta a, a t, a ta a a .T, , t, a a a, a a fi a a t .T , t, a a a, a fi a a t .T , t , t , a a a, a fi a a (F. 2) a a, a t t a, VOC t, t t .T , t t t a ta a t "K a a OC I G t Ga P a t P "(D at t , 2021) Ϊ, E a G E P t .A ¶tt а а t t t aa ta t t t t a at a 1.Fa,1, at aa thtt], 1<u>a</u> t t t а́Т а t t tit ti, a ta a tit ti, a a a t- i.S. fia,t a ta a atia a (Wa a ta t t ta a to a a (Wa a (Z. 2017) t а a tat -a ta., 2017) a /a t/a t a, at tt at a (Z, 2017) a t t а

### 5. Conclusions

ŧť t ŋ t t ť а а ₩ ;a ] al t а а а

CRediT authorship contribution statement

Data Ϋ a aala t.

**Declaration of Competing Interest** 

### Acknowledgments

тĨ taattNataAt 1 R а a P > t (DQGG202018, DQGG202142); G a K R a a D t P a (2020B1111360002).

### Appendix A. Supplementary data

S ta atat t atl /10.1016/<del>,</del> t t .2022.161295. 1 at tt :// 1. а

### References

- 785827.
- 785827. M t E a E t (MEE) P.R. C a,2020,A t t a t Nat a E t a P t t) Sa a "G' a d a t t' t' a t' t' t'. Nt' [2019] N .4. A d a tt:// . . / 2018/ / 01/202001 t 202001 13 758913. M t E a E t, t(MEE) P.R. C a,2021. Nt' t t' t t a t a a A a a aE At .2021 (65).. tt:// . . . / 2018/ 03/202108 t 2020 805 854161.

- A a'a 'aE' At .2021 (65).. tt :// . . / 2018/ / 03/202108/t 20210805 854161. M It E a E t (MEE), P.R. C' a, 2022. P a' t "E' | ta a a' tat 't' t "a t a' aa' tat 't' t a a a' tat 't' t a a a' t. N t! [2022] N . 24. A a' a 'a at' :// . . . / 2018/ / 01/2022111/t 20221117\_1005189. t . D at t E a E, t G a P , 2021. G a P K VOC I t G a' R .A a' a 'a tt :// . . . / Ft / Ff' a /12959.

- K
   VOC I
   t
   Gal
   R
   . A a a
   ia. tt://
   . . . / Ft/FM

   a
   /12959.
   Gat
   , G.I., C
   , M.M., M D, a, B.C., P
   , J., Al, K.C., G
   a, J.B., Ta
   ,

   M, Wa
   , C., 2021a. I
   tl
   al
   atta
   U.S.
   Ita
   U.S.

   Th, E
   . Sl. T
   . 55, 188–199.
   Gat
   , G.I., C
   , M.M., M D
   a, B.C., P
   , J., G
   a, J.B., Al, K.C., R

   R
   , M.A., Ca, a, F, P
   t, A.S.H., Ta
   , M., Wa
   , C., 2021. O, a if
   ta
   ta a a b
   t
   a
   ia
   ia
   ia
   ia
   ia
   ia
   ia
   ia
   ia
   ia
   ia
   ia
   ia
   ia
   ia
   ia
   ia
   ia
   ia
   ia
   ia
   ia
   ia
   ia
   ia
   ia
   ia
   ia
   ia
   ia
   ia
   ia
   ia
   ia
   ia
   ia
   ia
   ia
   ia
   ia
   ia
   ia
   ia
   ia
   ia
   ia
   ia
   ia
   ia
   ia
   ia
   ia
   ia

- Ú, G.H., W, W., S.a., X., N., L., Wa, H.L., Ya, X., Z.a., R., 2018. A alfiat, t. YQC, t.t.a., a.t.a. VOC atlita a.t.J.E.S., 67 (05), 78–88. U, M., Z.a., Q., Z., B., T., D., LI, Y., U., FI, t.a., 2019. P., t.t., t.a.t., -, t.a., a.a., a.a., (NMVOC) C.a., 1990-2017; , atla attita. At. C. P. 19, 8897-8913.

- 40 (9), 3942–3948.
- 1 (9), 3942-3940. 1 , R.Y., Z , M.F., Z a , X.Y., L , S.W., Ta , T.J., D, Y.S., H , M., Ua , X.M., H a , H.M., Fa , L.Y., Y , D.Q., 2021. C a at 11 t a P9(t ,)0(')30W, D, L1011 20 ;14:1(.3(')209C)0(82), 5(-2012), 21.22, 21.2

- S a, Q.E., Z , M.N., H a , H.W., Wa , Y.Z., H a , Z.J., 48.6(.)249(, Z)()0(,)-8.9

- Ya, B, H, W.W., Sa, M., Wa, M., C, W.T., L, S.H., ta., 2013. VOC, tattat, tatt
- Za, J.R., Ya, X.L., S, M., X, Y., Wa, S., Ca, D.X., U, J.H., 2021. E, J., aat ti, at a) a) a ta ta to ti Tlah. E J. Pt.Ct. 43 (05), 539–545. ZJY., Y, Y.F., M, Z.W., Za, Z., Wa, X.M., Y, S.S., P, K. Ya, Y., F, X.Q., Ca, H.H., 2013. I ta t, ca al a (VOC) fi a a at all to t Pa R D ta, Cla. Sl. Tta E ( 456–457.
- 456-457. Z G.S., 2017. T at ta at tat a C a. Pat. Pa a . 27 (2), 21-26. tt t <sup>4</sup>t